

***Schedule of papers circulated to Members of the Advisory Board of the  
Imperial Council of Agricultural Research for its meeting held at  
New Delhi on the 25th, 26th, 27th, 28th and 29th January 1932.***

**Notes on subjects 1 to 27 and 29 of Agenda.**

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**AGENDA FOR THE MEETING OF THE ADVISORY BOARD OF  
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH  
HELD AT NEW DELHI FROM THE 25<sup>TH</sup> TO 29<sup>TH</sup> JANUARY  
1932.**

1. Decisions of the Governing Body on the recommendations of the Advisory Board in June 1931.

2. (a) Promotion of scientific research in the Empire. Proposal from the Empire Marketing Board.

(b) Proposals from the Empire Marketing Board, London, in regard to further research in insecticides and fungicides.

3. The investigation of Indian fish poisons and other Indian forest products for their insecticidal properties.

4. Application from the Government of Madras for a grant of Rs. 49,930 spread over a period of five years for the extension of work on animal nutrition in the Madras Presidency.

5. Four schemes from the Indian Institute of Science, Bangalore--

A. Scheme for the preparation of cheap synthetic manure from town refuse and waste materials.

B. Scheme for the continuation of studies in electro-culture.

C. Scheme for the extension of sewage-farm investigations with special reference to Papaya and Plantain cultivation.

D. Scheme for the extension of work on "quality" in crops.

6. Scheme for the development of methodology in rural research submitted by the Vishwa Bharati Institute of Rural Reconstruction, Sriniketan.

7. Application from Lt.-Col. R. N. Chopra of the School of Tropical Medicine, Calcutta, for a grant for research in systematic collection of medicinal plants and study of food poisons in India.

8. Report of the Hemp Marketing Enquiry Officer.

9. Facilities for advanced study and research in agricultural science and cognate pure sciences in the United Kingdom.

10. Proceedings of the Fourth Meeting of the Sugar Committee held in December 1931.

11. Scheme for an economic enquiry into the cost of sugarcane production in the United Provinces, North Bihar, Bombay, the Punjab and Madras. Revised proposals for the carrying out of an enquiry into the cost of production of sugarcane, cotton and rotation crops.

12. Scheme for research work on the genetics of sugarcane at the Imperial Cane-Breeding Station, Coimbatore.

13. Application from the Government of His Highness the Maharaja of Mysore for a grant of Rs. 21,000 spread over a period of five years for the breeding of thick canes.

14. Scheme for the establishment of a sugarcane research station in the Punjab.

15. Application from the United Provinces Government for a grant of Rs. 1,76,810 for investigation into various problems of sugar industry in the United Provinces.

16. Schemes of research on sugarcane in the Madras Presidency :—

(a) Scheme submitted by the Madras Agricultural Department.

(b) Scheme submitted by Mr. A. N. Srinivasa Rao.

17. Scheme for a research and Testing station for the indigenous system of *gur* and sugar manufacture drawn up by the Sugar Technologist, Imperial Council of Agricultural Research.

18. Sugarcane Insect Pests (including the carriers of <sup>M</sup> Mosaic) scheme for work at Pusa.

19. Report of the third meeting of the Locust Committee—proposals for future research.

20. Proceedings of the First and Second Meetings of the Indian Oil Crushing Industry Committee appointed by the Imperial Council of Agricultural Research.

21. Proposals for the establishment of a Bureau of Information and Statistics and the appointment of Central Committee for oil-seeds.

22. Application from the Government of Bengal for the appointment of a cigar curing and blending expert for India and specially for Madras, Bengal and Burma.

23. Marketing of Agricultural Produce.

24. Scheme for the improvement of castor crop in India submitted by the Government of H. E. H. the Nizam. (Report of Committee).

25. Report of the Sub-Committee on the scheme for the establishment of an Agricultural Research Station at Risalewala (near Lyallpur) for the water requirements of crops.

26. Report of the Fruits Sub-Committee.

27. Report of the Sub-Committee on the scheme for experimental work on evolution of machinery for threshing and cleaning wheat in the Punjab.

28. Classification of research schemes recommended by the Advisory Board into classes according to importance and urgency in view of financial position.

29. Appointment of Mr. Kartha for six months to compile statistics showing the comparative efficiency of the different feeding scales adopted in the military dairies and of the effects of disease and other necessary factors on dairying efficiency.

30. Resolutions by Mr. K. Hewlett.

PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD  
OF THE IMPERIAL COUNCIL OF AGRICULTURAL RE-  
SEARCH HELD AT NEW DELHI ON MONDAY, THE 25TH  
JANUARY 1932.

The following were present :—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, *Chairman*.
2. Rao Bahadur D. ANANDA RAO GARU.
3. Mr. A. D. BLASCHECK.
4. Dr. LESLIE COLEMAN.
5. Mr. G. K. DEVADHAR.
6. Mr. R. S. FINLOW.
7. Dr. M. O. FORSTER.
8. Dr. N. N. GANGULEE.
9. Major-General J. D. GRAHAM.
10. Mr. K. HEWLETT.
11. Mr. NIZAM-UD-DIN HYDER.
12. Mr. P. J. KERR.
13. Mr. T. F. MAIN.
14. Dr. W. McRAE.
15. Mr. N. C. MEHTA.
16. Mr. D. MILNE.
17. Colonel A. OLVER.
18. Mr. T. F. QUIRKE.
19. Mr. D. R. SETHI.
20. Mr. G. T. TAIT.
21. Mr. F. WARE.

Mr. M. S. A. HYDARI, *Secretary*.

The following attended as Visitors :—

1. Dr. S. P. AGHARKAR.
2. Mr. MILLER BROWNLIE.
3. The Hon'ble Major-General J. W. D. MEGAW.
4. Mr. R. C. SRIVASTAVA.
5. Prof. V. SURRAHMANYAN.

The meeting lasted from 11 A.M. to 1 P.M. and adjourned till 10-30 A.M. on the 26th January to allow the Sub-Committee on the scheme for the establishment of an Agricultural Research Station at Risalewala (near

Lyallpur) for work on the water requirements of crops to meet in the afternoon.

2. *Decisions of the Governing Body on the recommendations of the Advisory Board in June 1931. (Subject No. 1 of the Agenda). Appendix I.*—Noted.

3. The Board considered the four schemes submitted by the Indian Institute of Science, Bangalore (*Item 5 of the Agenda*).

(i) *Item 5 (a). (Appendix II).—Scheme for the preparation of cheap synthetic manure from town refuse and waste materials.*—Dr. Forster introduced the scheme which was also explained by Prof. Subrahmanyan under whose direction the scheme would be conducted at the Indian Institute. Dr. Coleman while supporting the scheme drew attention to the work of Dr. Fowler in this connection and referred to the efforts now being made by a Committee under his chairmanship to adapt the results obtained by Dr. Fowler to the disposal of sewage in Mysore City. He stressed the importance of collaboration in this work between the Indian Institute and the Mysore Committee. The fact that work was being carried on at two centres so close to one another without one knowing what the other was doing pointed a moral for the rest of India; he felt convinced that, on enquiry, it would be found that a great deal of money was being wasted in India through lack of co-ordination of scientific work on similar problems. Dr. Forster and Prof. Subrahmanyan both assured the Board that there was no idea of ignoring Dr. Fowler's work—in fact the scheme of research now proposed was based on the latter's work. Nor was there any danger of overlapping, as Dr. Fowler was a member of the Council of the Institute and would doubtless keep himself in close touch with this piece of research, if sanctioned. The importance of collaboration in scientific effort in India was also stressed by several speakers, notably Dr. Gangulee, Mr. Milne and Mr. Mehta. The last mentioned referred to a proposal he had already made to the Council in another connection that research programmes of Provincial Departments of Agriculture should be collated and circulated by the Council. He also pointed out the importance of suitable personnel in the conduct of any piece of research viewed from that aspect everything was in favour of this research being conducted at the Indian Institute, where a highly trained staff was available. Mr. Quirke and Mr. Devadhar suggested that the scheme should be referred back for eliciting information as to what was being done in this connection in other provinces.

In the result the Board recommended the scheme for sanction.

(ii) *Item 5 (b). (Appendix III).—Scheme for the continuation of studies in electro-culture.*—Dr. Forster in introducing the scheme stated that the Institute had already spent Rs. 2,000 of its own money on this work which held out great possibilities for the improvement of agriculture. Dr. Gangulee doubted whether in the present state of India's development electro-culture was of much practical importance, an opinion with which Mr. Sethi agreed. Prof. Subrahmanyan replied that these studies had already been recognised by such institutions as the Institute of Brewing and Rothamsted as being of practical importance, and he was supported in his view by Mr. Mehta who referred to the valuable work of Dr. Nehru in the United Provinces. Dr. Nehru, he said, had demonstrated

that, for example, treatment of seeds by electricity ensured greater resistance to diseases in such seeds; but he agreed with Professor Agharkar that, while Dr. Nchru's results were very important, they required to be repeated under accurate laboratory conditions and that the scheme submitted by Professor Subrahmanyam was a step in the right direction. Mr. Mehta added that in the United Provinces at any rate electricity could be made available for agricultural operations to a considerable extent, as nearly half of that province could now be served with power. Colonel Olver sounded a note of warning regarding the contraction of the funds at the disposal of the Council and the consequent necessity of limiting grants henceforward to schemes of real importance. Dr. Forster replied that it was difficult to say at the outset which of several different schemes of research would yield results of greater importance and that in any case the function of this Board was to shroff schemes of research from the scientific point of view leaving the question of allocation of funds to the Governing Body of the Council.

The Board did not, however, see its way to recommend the scheme for sanction.

(iii) *Item 5 (c). (Appendix IV).—Scheme for the extension of sewage-farm investigations with special reference to Papaya and Plantain cultivation.*—Subject to the proviso that attempts should be made to ascertain what work, if any, was being conducted in this direction at centres such as Mysore, Nagpur, Poona, etc., where there were sewage farms in existence, the Board recommended the scheme for sanction.

(iv) *Item 5 (d). (Appendix V).—Scheme for the extension of work on "quality" in crops.*—Dr. Gangulee and Dr. Coleman referred to the work of Colonel MacCarrison and Mr. Viswanath in this connection and suggested the need for collaboration between the different workers on the subject. Obtaining from Dr. Forster the assurance that this matter would as heretofore continue to be kept in mind and subject to the proviso that the work would be restricted to one definite crop, namely, rice, the Board recommended the scheme for sanction.

4. *Application from Lt.-Col. R. N. Chopra of the School of Tropical Medicine, Calcutta, for a grant for research in systematic collection of medicinal plants and study of food poisons in India. (Subject No. 7 of the Agenda) (Appendix VI).*—The Chairman announced that Colonel Chopra was unavoidably prevented from attending the meeting of the Board to explain the scheme, but invited members all the same to comment upon it on the information contained in the papers circulated already. Mr. Mehta said that the problem of the systematic cultivation of medicinal plants was taken up in the United Provinces several years ago and during the War years cultivators made considerable profit by the cultivation of such plants. With the return of normal peace conditions the problem which was chiefly an economic one was—how to get cultivators to grow the right varieties of medicinal plants; and it was to the economic side of the question which he would like Colonel Chopra, whose scheme he supported, to pay paramount importance. Mr. Milne suggested that Colonel Chopra should get into touch with the Forest as well as with the Agricultural Departments. Mr. Ware pointed to the need for collaboration of the Veterinary Departments also in so far as the study of food poisons was concerned. Mr. Blascheck while supporting the scheme was of the

opinion that the staff proposed was not sufficient to undertake work on such a broad front as indicated by Colonel Chopra. Speaking from his experience in the utilisation of minor forest produce, he suggested that work should be concentrated on a few plants. Dr. Agharkar doubted the suitability of Calcutta for this research as most of the medicinal plants were Alpine plants and required a temperate or a cold climate for proper cultivation. In his opinion the question of working up the cultivation of medicinal plants in India was largely a question of organisation. General Megaw who was invited by the Chairman to give his views said that the scheme was very desirable in itself especially as giving an opportunity of linking up medical with agricultural and veterinary research. Nor had he any doubts as to Colonel Chopra's competence to undertake the enquiry. In view, however, of his already heavy duties as Professor and as Director of other research enquiries, he doubted whether Colonel Chopra would be able to devote adequate attention to this new line of enquiry. While he had no desire whatever to dissuade the Board from recommending the present scheme for sanction, he would prefer a more comprehensive scheme being worked out in collaboration with the various interests concerned, such as the Forest, Agricultural, Botanical and Veterinary Departments. Dr. Coleman informed the Board that in Mysore the Medical and the Forest Departments were co-operating in this work. He was afraid that the one Botanist provided for the scheme would not be able to do much of value and felt that this survey work would have to be carried out by officers of the local departments, Forest or otherwise. In Dr. Forster's opinion the chemical part of the scheme was defective. One chemist getting as low a pay as Rs. 250 to Rs. 350 per month with two untrained laboratory assistants would not turn out satisfactory work. Whatever chemical work Dr. Chopra required to be done would be better done if he referred it to an Institute where proper facilities for the conduct of such work were available, such as the Dehra Dun Forest Research Institute, the Indian Institute of Science or any University where there was a good chemical side. General Graham, while paying a tribute to Colonel Chopra's eminence as a research worker, referred to the criticisms he had made to Mr. Burt on the original scheme as far back as the middle of 1930. For example, no proposals for plant growing were included in this piece of research, nor at that time had there been any immediate co-ordination of the proposed work with that of the Botanical Survey. He had then suggested that, if the proposals were better defined and perhaps narrowed down somewhat, the scheme could be supported *prima facie*. Mr. Devadhar supported on the grounds of promotion of indigenous industries and swadeshi enterprise and economy. It would create great activity in the Forest Departments of various provinces thus checking considerably the present 'drain' in this direction as stated by Colonel Chopra in his note on the subject. At this stage the Chairman suggested that as several members had raised points of enquiry which Colonel Chopra alone could satisfactorily deal with, the Board might defer consideration of this scheme till Colonel Chopra could attend and reply to the points raised. The Board agreed.

M. S. A. HYDARI,

*Secretary.*

25th January 1932.

PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD  
OF THE IMPERIAL COUNCIL OF AGRICULTURAL RE-  
SEARCH HELD AT NEW DELHI ON TUESDAY, THE 26TH  
JANUARY 1932.

The following were present :—

1. Diwan Bahadur Sir T. VIJAYARAOHAVACHARYA, *Chairman.*
2. Rao Bahadur D. ANANDA RAO GARU.
3. Mr. A. D. BLASCHECK.
4. Dr. LESLIE COLEMAN.
5. Mr. G. K. DEVADHAR.
6. Mr. R. S. FINLOW.
7. Dr. M. O. FORSTER.
8. Dr. N. N. GANGULEE.
9. Major-General J. D. GRAHAM.
10. Mr. K. HEWLETT.
11. Mr. NIZAM-UD-DIN HYDER.
12. Mr. P. J. KERR.
13. Mr. T. F. MAIN.
14. Dr. W. McRAE.
15. Mr. N. C. MEHTA.
16. Mr. D. MILNE.
17. Colonel A. OLVER.
18. Mr. F. J. PLYMEN.
19. Mr. T. F. QUIRKE.
20. Major P. B. RILEY.
21. Mr. D. R. SETHI.
22. Mr. G. T. TAIT.
23. Mr. F. WARE.

Mr. M. S. A. HYDARI, *Secretary.*

The following attended as Visitors :—

1. Dr. S. P. AGHARKAR.
2. Mr. R. C. SRIVASTAVA.
3. Professor V. SUBRAHMANYAN.
4. Mr. V. R. TAMHANE.

The meeting lasted from 10-30 a.m. to 1-10 p.m., and adjourned till 10-30 a.m. on the 27th January to allow the Sub-Committee on Fruit Schemes to meet in the afternoon.



2. *Scheme for the development of methodology in rural research submitted by the Vishwa Bharati Institute of Rural Reconstruction, Sriniketan. (Subject No. 6 of the Agenda). (Appendix VII).*—Mr. Finlow introduced the scheme. Dr. Gangulee suggested that in the present depressed state of the Council's finances the Advisory Board should recommend that the Council should bear the cost of one assistant for statistical work leaving the rest of the expenditure to be borne by the Institute. This would be a mark of good-will on the part of the Council towards the Institute. Several members were of opinion that if the Council gave a grant to the Institute at all, it should not be of the trifling nature suggested. Other members also pointed to the need for some kind of supervision over the scheme by the economist whom the Council proposed to appoint in connection with the proposal for an economic enquiry into the cost of sugarcane cultivation. Mr. Nizam-ud-Din Hyder agreed that this would be desirable. Dr. Ameer Ali was a very capable young man who had been trained under him, but the latter would himself appreciate the guidance of an experienced economist.

In the result the Board agreed to recommend the scheme for sanction on the following conditions :—

- (i) That the Council and the Institute should share in the expenditure on a 50 : 50 basis, and
- (ii) that the work would be under the general supervision of the Council's economist when and if such a post was created.

3. *Report of the Hemp Marketing Enquiry Officer.—(Subject No. 8 of the Agenda). (Appendix VIII).*—Mr. Milne suggested that a small committee representative of all the interests concerned should consider the report, whose publication should in the meantime be deferred. Messrs. Plymen, Finlow and Mehta were however of the opinion that the report should be released immediately for publication, it being made clear that the statements contained in it were not made under the authority of the Council and that the whole report would be examined by a representative Committee. Dr. Gangulee suggested that the report should show on its cover that it was issued under the auspices of the Council. As it was, there was nothing to differentiate it from any ordinary Government publication. The report itself he criticised as not being comprehensive enough. Mr. Sabnis, for example, did not deal with the question as to why Russian and Italian hemp was ousting Indian hemp in the European market. Dr. Förster said that Dr. Gangulee was asking for too much. The report was not intended to be the final word upon the subject, but rather a starting point and a basis for further enquiries. He felt sure that it would result in a good deal of valuable discussions and was for that reason in favour of its immediate publication. Mr. Mehta said that Mr. Sabnis was not an economist, but an agriculturist, and it was to the agricultural side of the question that Mr. Sabnis had rightly devoted himself. It would now be the function of economists to do their share of the enquiry. Mr. Plymen in supporting Mr. Mehta referred to the very great difficulty of extracting information about marketing of hemp from the trade interests concerned and he desired that Mr. Sabnis' report should be published as showing the defects on the agricultural side which may induce the trade interests concerned to come forward with a statement of marketing difficulties.

In the result the Board agreed that the report should be released for publication immediately with a notice that the Council accepted no responsibility for the statements contained therein ; and also that a committee of about nine members representative of all the interests concerned be nominated by the Chairman of the Board to examine the report with a view to recommending such action thereon as the committee may consider necessary. In this connection Mr. Devadhar suggested in the light of what Mr. Sabnis has stated in his Report on page 37 that one of the nine members that would go to constitute should be a worker in the co-operative field as co-operative societies formed for this purpose would enable the hemp growers to secure the highest possible pecuniary benefit to themselves from this trade.

4. *Facilities for advanced study and research in agricultural science and cognate pure sciences in the United Kingdom. (Subject No. 9 of the Agenda). (Appendix IX).*—The Board had no suggestions to make in respect of the English volume. Messrs. Hyder, Coleman and Forster on behalf of the Nizam's Government, the Mysore Government and the Indian Institute of Science, Bangalore, respectively, suggested that in preparing the Indian volume, information should be asked for from the Hyderabad and Mysore Departments of Agriculture and from the Indian Institute of Science. The Chairman noted this suggestion and the Board passed on to the consideration of the next subject.

5. *Proceedings of the fourth meeting of the Sugar Committee held in December 1931 (Subject No. 10 of the Agenda). (Appendix X).*—These were noted.

6. *Scheme for research work on the genetics of sugarcane at the Imperial Cane-Breeding Station, Coimbatore. (Subject No. 12 of the Agenda). (Appendix XI).*—Mr. Srivastava commended the scheme to the favourable consideration of the Advisory Board as being both useful and modest in respect of expenditure. The Board recommended the scheme for sanction.

7. *Application from the Government of His Highness the Maharaja of Mysore for a grant of Rs. 21,000 spread over a period of five years for the breeding of thick canes. (Subject No. 13 of the Agenda). (Appendix XII).*—Dr. Coleman in introducing the scheme said that Mysore had a notable record in the matter of research in cane breeding for the cultivation of which Mysore was climatically well suited. In fact climatic conditions in Mysore were very similar to those in those parts of Java where the breeding operations of the East Java Sugar Experiment Station are now being carried on, viz., the Malang Plateau. The scheme under consideration, if recommended, would afford much needed assistance to Dr. Badami, the Mysore Economic Botanist, to continue in a more systematic manner the work which he was already doing on cane as part of his other work. In Mysore improved canes had spread over half the total sugarcane area and had even been exported outside Mysore. Dr. Coleman wished it clearly to be understood that they did not in any way desire to compete with the work of the Imperial Sugarcane Station at Coimbatore with whom their policy was one of co-operation and not competition. Mr.

Main supported the scheme as being of definite utility to Bombay which was unsuitable for breeding. They had therefore to depend on Madras and Mysore and they had already imported several canes including the very promising H. 19.320 from the latter place. Mr. Devadhar supported the scheme as it was to help the sugar industry in the Bombay Presidency.

After several other members had spoken in support, the Board recommended the scheme for sanction.

8. *Scheme for the establishment of a sugarcane research station in the Punjab.—(Subject No. 14 of the Agenda). (Appendix XIII).*—Dr. Gangulee enquired as to the nature of work the Sugarcane Specialist would have to do and also why the proposed salary of Rs. 250—25—500 for him was fixed on a higher scale than in the Mysore scheme. Mr. Milne explained that the Specialist would be in charge of the scheme. His salary had been fixed after taking into consideration the amount necessary for attracting a suitable man. Dr. Coleman explained that in Mysore the general scale of salaries was lower than in British India. The Sugarcane Specialist in Mysore would be placed under some superior officer, so that a man with less experience would be sufficient. Dr. Gangulee was however not satisfied and expressed the opinion that both the men in Mysore as well as in the Punjab should be paid the same salary by the Imperial Council of Agricultural Research; if the Punjab Government were unable to secure the services of a suitable man at this salary they were at liberty to pay more from their own budget.

Mr. Main pointed out the necessity for co-ordination between the four schemes and stated that the reply given by Mr. Burt to the Sugar Committee "that these schemes were the result of our previous decision to have a chain of research stations in the main sugarcane belt" did not satisfy him. He considered that there should be co-ordination in selecting the type of work which each province should undertake so that there may be no unnecessary duplication. Mr. Milne considered that it was not possible to co-ordinate work in this manner, although the pooling of results obtained was not only feasible but desirable.

Mr. Plymen said that on the small salaries proposed it would be difficult to get suitably qualified staff and that the Punjab Government should arrange for suitable technical staff from Lyallpur or elsewhere. He also considered that the problem on the technological side was an all-India one and there was necessity for co-ordination in respect of this. Mr. Mehta pointed out that the Sugar Technologist would function as the co-ordinating agent on the technological side and on the agricultural side the Coimbatore station would perform the same function, as the testing work at the proposed research stations would be confined to the Coimbatore varieties. Dr. Gangulee said that if the work of the research stations was to be confined to testing only and there was to be no breeding work, there was no necessity for the technical and chemical staff provided for in the schemes and that all the schemes should therefore be referred back to the Sugar Committee for reconsideration. Mr. Sethi pointed out that the North Bihar scheme which had already been sanctioned was also for providing a purely testing station and the salary of the Specialist for that station was also Rs. 350. In Northern India it was difficult to get a suitable man on a lower salary. Dr. Subrahmanyam considered that unless

there was co-ordination, there was bound to be duplication of work and it would also be difficult to compare the work done at the different stations. He suggested that there should be some provision for collecting all the information at one place as was being done in foreign countries. Mr. Milne agreed that collaboration was necessary in so far as the collection of data in one place was concerned. Mr. Mehta pointed out that Dr. Subrahmanyam's point did not arise as the schemes provided for testing the Coimbatore seedling canes under local conditions obtaining in different parts of the country. As regards the standardisation of pay he considered that this might be left to the Vice-Chairman. The agricultural aspect of the work would be definitely under Mr. Venkataraman, who would be sending out the seedlings. Mr. Plymen said that if these were to be only testing stations the work should properly be done by the provincial departments of agriculture. Dr. McRae considered that the problems were of local importance and should be dealt with by local scientists. Mr. Milne supported this view but added that the provincial departments had no spare staff which they could put on this work.

Dr. Gangulee at this stage formally moved the following amendment which was seconded by Mr. Main.

“ Recommended that the three sugarcane schemes for the North of India covered by items Nos. 14, 15 and 17 of the Agenda be referred back to the Sugar Committee for co-ordination with special reference to the definition of problems and allotment of work.”

Mr. Mehta opposed the amendment saying that Bombay and Bihar had already received grants for exactly similar work and it would be unfair to the other provinces to refuse the grant to them. Mr. Srivastava pointed out that co-ordination, on which so much stress had been laid, could be of two kinds—firstly—one central authority prescribing and controlling the work of the stations in all the technical details, *e.g.*, the selection of problems and the manner of conducting the researches. He considered that co-ordination of this kind was not provided for and was in fact not required. Secondly, co-ordination might be in the sense of pooling the information available at the different stations. Such co-ordination was desirable and was provided for by the Imperial Council of Agricultural Research which acted as a clearing house in such matters. Mr. Finlow emphasised the importance of separating the technological work from the Punjab scheme. Mr. Sethi supported this view. Rao Bahadur Ananda Rao considered that, if the main work at this station was confined to a testing of seedling canes from Coimbatore, there was no need for a sugarcane specialist as a cheaper man could manage the work. He, however, thought that the scheme need not be referred back to the Sugar Committee on the score of want of collaboration. What was required, he thought, was to define the kind of collaboration that was needed. Dr. Agharkar said that testing seedling canes was an all-India matter but manufacturing of *gur* was of local importance and therefore the two should be separated. Dr. McRae however differed from this view and considered that seed testing was a strictly local problem. Mr. Srivastava pointed out that the provision made in the schemes for *gur* and sugar making was on a very limited scale and it was not so much for carrying on research in the *gur* making industry as to utilise the facilities available for converting the sugarcane

which was cultivated for experimental purposes into a saleable product. Mr. Milne supported this.

As Dr. Gungulee's amendment referred to items Nos. 14, 15 and 17, the Chairman ruled that it should be taken up after the remaining two items Nos. 15 and 17, had been discussed.

M. S. A. HYDARI,  
*Secretary.*

*26th January 1932.*

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PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD  
OF THE IMPERIAL COUNCIL OF AGRICULTURAL RE-  
SEARCH HELD AT NEW DELHI ON WEDNESDAY, THE 27<sup>TH</sup>  
JANUARY 1932.

The following were present :—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, *Chairman*.
2. Rao Bahadur D. ANANDA RAO GARU.
3. Mr. G. D. BLASCHECK.
4. Dr. LESLIE COLEMAN.
5. Mr. G. K. DEVADHAR.
6. Mr. R. S. FINLOW.
7. Dr. M. O. FORSTER.
8. Dr. N. N. GANGULEE.
9. Major-General J. D. GRAHAM.
10. Mr. K. HEWLETT.
11. Mr. NIZAM-UD-DIN HYDER.
12. Mr. P. J. KERR.
13. Mr. T. F. MAIN.
14. Dr. W. McRAE.
15. Mr. N. C. MEHTA.
16. Mr. D. MILNE.
17. Colonel A. OLVER.
18. Mr. F. J. PLYMEN.
19. Mr. T. F. QUIRKE.
20. Major P. B. RILEY.
21. Mr. D. R. SETHI.
22. Mr. G. T. TAIT.
23. Mr. F. WARE.

Mr. M. S. A. HYDARI, *Secretary*.

The following attended as Visitors :—

1. Dr. S. P. AGHARKAR.
2. Mr. R. C. SRIVASTAVA.
3. Prof. V. SUBRAHMANYAN.

2. *Application from the United Provinces Government for a grant of Rs. 1,76,810 for investigation into various problems of sugar industry in the United Provinces. (Subject No. 15 of the Agenda). (Appendix XIV).—* Mr. Mehta in introducing the scheme explained that it consisted of three parts, namely, the Agricultural, Technological and Economic. The Economic part had now been absorbed in item No. 11 relating to the scheme

for economic enquiry into the cost of sugarcane production. The Technological part, according to Mr. Mehta, was on a very modest scale, as the nett expenditure involved amounted to only Rs. 4,250. As regards the Agricultural side it was explained that this was on lines similar to those of the Punjab scheme, but was on a more modest scale. Mr. Srivastava referred to the Technological side of the scheme and explained that if the work was done by the Sugar Technologist under his scheme for a Research and Testing station, the Research Council would have to bear the full cost of Rs. 17,000, whereas if the scheme of the United Provinces Government was sanctioned only a quarter of this amount would have to be paid by the Research Council. Dr. Gangulee considered that this scheme was subject to the same objections as the Punjab scheme. The scope of work was not confined to the testing of seedlings only, but extended to manurial experiments and to the whole gamut of the questions of sugarcane agriculture. He emphasized that the problems to be studied were not sufficiently well-defined. On the Technological side the scheme appeared to aim at demonstration work in connection with the use of hydro-electric power instead of carrying on any fundamental research. Dr. Agharkar referred to agricultural work described under sub-heading (c), namely, Physiological and Chemical investigations and considered that the work was of too wide a nature. Mr. Mehta explained that the Sub-Committee had not sanctioned this part of the programme and that the physiological and chemical work had therefore been omitted. Mr. Sethi referring to the salaries of staff considered the scale of pay to be high. On the Technological side he recommended that the work should be transferred to the Sugar Technologist. Mr. Devadhar enquired to what extent was the Co-operative Departmental machinery utilized in the scheme as mentioned in the paper by the mover and further wanted to know what kind of help was rendered to the Department of Industries. Mr. Mehta explained that the Technological work would be under the Sugar Technologist. The Irrigation Department, United Provinces, would bear the expenses of making electric connections and fitting up the machinery. As regards the staff he stated that the Economic Botanist to the United Provinces Government, who was now stationed at Shahjahanpur, has also to look after the work of the Rice Scheme which was located at a distance of over 100 miles from Shahjahanpur and it would be difficult for him to give sufficient attention to the sugarcane scheme also.

In reply to Mr. Main's enquiry if the United Provinces Government had agreed to take back the plant and pay 75 per cent. of the cost, Mr. Mehta stated that this had been agreed to. Dr. Coleman considered that the scheme was top heavy and suffered from the same defects as the Punjab scheme and should therefore be reconsidered. In reply to Mr. Finlow, Mr. Srivastava explained that the technological work was not pure demonstration, but consisted of experiments in the adaptation of hydro-electric power for sugar-making and later on the demonstration of the plant so perfected. In the end Dr. Gangulee moved his amendment, which was seconded by Mr. Main, that "The three sugarcane schemes for the North India covered by items Nos. 14, 15 and 17 of the agenda be referred back to the Sugar Committee for co-ordination with special reference to the *definition* of problems and allotment of work".

The Chairman ruled that the amendment should be taken up after item No. 17 had been discussed.

3. *Scheme for a Research and Testing station for the indigenous system of gur and sugar Manufacture. (Subject No. 17 of the Agenda). (Appendix XV).*—The scheme was introduced by Mr. Srivastava, who after explaining its main features, emphasized that it was of an all-India importance as there was great demand all over the country for small scale plants for sugar and *gur* making and that if these were not provided, sugarcane cultivation would receive a severe set back. He also added that the actual nett cost of the scheme was likely to be appreciably smaller than that stated, as on completion of the work the machinery, buildings and other material would be disposed of which should result in substantial recoveries. He finally added that the present scheme was intended to take a comprehensive view of the entire problem of the indigenous industry and as such deserved the support of the Board.

Mr. Finlow supporting the scheme considered it to be of great importance as without suitable means for dealing with the sugarcane crop the cultivation of cane would be seriously affected. Mr. Main agreed in regard to the importance of the work covered by the scheme, but enquired as to why it could not be amalgamated with work at Cawnpore for which the Council had already given a grant. He also stated that as the Sugar Technologist will not remain at the proposed research station all the time, the Chemist and Engineer provided in the scheme should be of a better type. Dr. Coleman stated that the work would be of importance to Southern India also. He expressed the opinion that the work could not be completed in five years, so the expected recoveries from the disposal of plant and building would not materialize. Professor Agharkar referred to the small amounts provided in the scheme for the equipment and building for the laboratory. He considered that with a laboratory on such a small scale, research of a fundamental nature would not be possible. He also pointed out that instead of the proposed arrangement whereby cane was to be provided by some farm owner and the produce was to be taken back by him, it would be more economical if the Shahjahanpur farm (which would now be financed by the Council) should supply cane free to the proposed research station, in which case the station may be located at Shahjahanpur. Rao Bahadur Ananda Rao enquired as to the nature of work to be done during the off-season when cane crushing is stopped. Mr. Plymen was of the opinion that it would be more logical to locate in one place and co-ordinate the four schemes for the United Provinces, *e.g.*, the Testing Station at Shahjahanpur, the grant given to the Harcourt Butler Technological Institute and the two schemes covered by items 15 and 17. (Appendices XIV and XV).

Mr. Srivastava replying to the debate stated that it was not proposed to locate the research station at Cawnpore, because it was not a centre for sugarcane cultivation. For the small experimental sugar factory, special arrangements had been made for cultivating a small quantity of cane in the local Government farm, but the cost of this would be very high. As regards the objection that the Sugar Technologist would not remain at the research station, he explained that his presence there all the time was not essential. It would be sufficient if he visited the station, say, once a month during the cane season and the necessary reports were regularly sent to him by the staff there. As regards the likelihood of completion of the work in five years it was explained that schemes for grant from the Council were under the rules restricted to a period of not



more than five years, and the present scheme had been framed accordingly. On the expiry of this period the question of continuance of the work will again be brought before the Council. With regard to Professor Agharkar's enquiry as to the equipment and buildings for the laboratory, it was stated by Mr. Srivastava that elaborate laboratory equipment was not required, as the laboratory was intended primarily for carrying on "Chemical Control Work" of the manufacturing operations and would therefore be equipped on lines similar to those of the commercial sugar factory laboratories which did not cost very much more. Where any expensive instruments were required, these could be always borrowed from the Technological Institute and the Department of Agriculture, both of which were closely co-operating with the Sugar Technologist. With regard to Rao Bahadur Ananda Rao's enquiry as to the nature of work to be done during the off-season, Mr. Srivastava explained that this would consist essentially of work supplementary to that in the cane crushing season, e.g., tabulation of results, preparation of reports, etc.

Mr. Mehta, further replying to the debate, stated that the Shahjahanpur farm could not supply cane free of cost as suggested by Professor Agharkar as the Research Council would be contributing only part of the expenses of running the farm, and that the grant would be utilized entirely for the experiments coming under the scope of the scheme. Replying to Mr. Plymen's criticism of duplication amongst the four United Provinces schemes he stated that the experimental factory at the Technological Institute was meant entirely for work in connection with the modern sugar factory industry, whereas the present scheme was for small scale indigenous sugar and *gur* making industry. He referred to the useful work which was being done by the Sugar Technologist, who had been able to give help to a large number of persons in connection with schemes for modern type of factories as well as for the small indigenous units. He considered that the offer of the Sugar Technologist to undertake fresh work as contemplated in the scheme under consideration should be accepted and the scheme passed.

After the Vice-Chairman had assured the Board that referring back would not involve delay in submitting the Sugar Technologist's scheme to the Governing Body, Dr. Gangulee finally moved his amendment which was seconded by Mr. Main, that "The three Sugarcane schemes for the North of India covering items Nos. 14, 15 and 17 of the Agenda (Appendices XIII, XIV and XV) be referred back to the Sugar Committee for co-ordination with special reference to the *definition* of problems and allotment of work". The amendment was carried.

4. *Scheme of research on sugarcane in the Madras Presidency. Scheme submitted by the Madras Agricultural Department.* [Subject No. 16 (a) of the Agenda]. (Appendix XVI).—Rao Bahadur Ananda Rao introduced the scheme. He considered that necessary details were contained in the scheme and he was therefore not clear as to why it had been referred back by the Sugar Committee. Mr. Mehta intervening stated that the Sub-Committee appointed by the Sugar Committee for considering the sugar schemes was unable to follow the details of the Madras scheme and had therefore decided that further details should be obtained from the Madras Government and a revised scheme placed before the Committee. The Chairman added that it was suggested in the Sugar Committee that the Vice-Chairman or the Agricultural Expert should meet representatives

of the Madras Government and explain to them the lines on which the scheme should be re-drafted.

Dr. Gangulee stated that the Sub-Committee's report was not sufficiently precise in stating that "they had not sufficient information before them to come to a definite conclusion on the financial details presented". He considered that the Madras scheme was as good or as bad as the United Provinces and Punjab schemes. Dr. Coleman supported Dr. Gangulee. Dr. Gangulee also added that referring to the list of grants given to the various provinces, it was observed that Madras had received inadequate consideration from the Council.

Professor Agharkar suggested that the technical side of the scheme should be amalgamated with the Sugar Technologist's scheme. He also pointed out that according to the Madras Scheme, the Madras Government were going to hand over Rs. 14,000 annually to the Research Council, whereas the Government of the United Provinces were not willing to supply cane free of charge from the Shahjahanpur farm.

Dr. Subrahmanyan pointed out that provision had been made in the scheme for residential buildings, which was contrary to the principle followed by the Council in giving grants. The Chairman explained that when the financial details of the scheme were examined all such items would be scrutinized. Dr. Coleman recommended that the scheme be sent back to the Madras Government for revision and that it should then be placed before the Sugar Committee, after which it should be referred back to the Advisory Board. He particularly desired the Sugar Committee to be informed that their attitude towards this scheme was to be deprecated as the scheme was considered to be as good as the other two provincial schemes. Dr. Gangulee moved and Mr. Plymen seconded that "the Board supports the Madras scheme subject to financial and technical details being presented to the Sugar Committee and that it may be referred to the Governing Body". The resolution was rejected by a majority of one vote by the Board which decided unanimously that the scheme after revision by the Madras Government should be re-considered by the Sugar Committee and should thereafter be referred back to this Board.

5. *Scheme of research on sugarcane in the Madras Presidency. Scheme submitted by Mr. A. R. Srinivasa Rao. [Subject No. 16 (b) of the Agenda].*—The Chairman informed the meeting that this item\* may be postponed as fresh representation had been received from Mr. A. R. Srinivasa Rao which will be placed before the next meeting of the Board.

6. *Sugarcane Insect Pests (including the carriers of Mosaic) scheme for work at Pusa. (Subject No. 18 of the Agenda). (Appendix XVII).*—Dr. McRae in introducing the subject stated that the work comprised under this scheme was of an important nature and he moved that the decision of the Sugar Committee be reversed. Mr. Hewlett seconded the motion.

Professor Gangulee enquired if any entomological work on sugarcane had been done at Pusa. Dr. McRae gave details of the work done and explained that if the present scheme was sanctioned, it will become possible to carry on more definite and intensive work. Dr. Coleman was

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\*The scheme will be found printed as Appendix XIII to the proceedings of the meeting of the Advisory Board held in June 1931.

of the opinion that the work was of an important nature and should be done. But as Mr. Fletcher was not in a position to accept alterations, the Sugar Committee may be asked to go into the matter once more and get a more modest scheme prepared. This was however objected to as beyond the scope of the Sugar Committee. Mr. Milne suggested that the work may be done on lines similar to those adopted by the Indian Central Cotton Committee by selecting scholars to work in those localities where the pests occur and to set up a co-ordinating committee for controlling the work of the scholars.

The Committee then adjourned for the day.

R. C. SRIVASTAVA,

*27th January 1932.*

*for Secretary.*

PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD  
OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH  
HELD AT NEW DELHI ON THURSDAY, THE 28<sup>TH</sup> JANUARY  
1932.

The following were present :—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, *Chairman*.
2. Rao Bahadur D. ANANDA RAO GARU.
3. Dr. LESLIE COLEMAN.
4. Mr. G. K. DEVADHAR.
5. Mr. R. S. FINLOW.
6. Dr. M. O. FORSTER.
7. Dr. N. N. GANGULEE.
8. Mr. K. HEWLETT.
9. Mr. NIZAM-UD-DIN HYDER.
10. Mr. P. J. KERR.
11. Mr. T. F. MAIN.
12. Dr. W. McRAE.
13. Mr. N. C. MEHTA.
14. Mr. D. MILNE.
15. Col. A. OLVER.
16. Mr. F. J. PLYMEN.
17. Mr. T. F. QUIRKE.
18. Mr. D. R. SETHI.
19. Mr. G. T. TAIT.
20. Mr. F. WARE.

Mr. M. S. A. HYDARI, *Secretary*.

The following attended as visitors :—

1. Dr. S. P. AGHARKAR.
2. Mr. F. J. WARTH.
3. Mr. R. C. SRIVASTAVA.
4. Prof. V. SUBRAHMANYAN.
5. Mr. V. A. TAMHANE.
6. Dr. L. K. HYDER (in the afternoon).

The meeting lasted from 10-30 A.M. to 5-45 P.M. with an interval for lunch from 12-45 P.M. to 3 P.M.

2. *Sugarcane Insect Pests (including the carriers of Mosaic) scheme for work at Pusa (Subject No. 18 of the Agenda). (Appendix XVII).—* Dr. Gangulee considered the scheme too expensive and was against the expenditure being incurred. Mr. Finlow said that if the Board rejected the

scheme it should at least add a rider that it recognised the importance of the borer so that perhaps another scheme more acceptable to the Board could be submitted in due course. Mr. Milne suggested that a Committee of Entomologists and Mycologists should be created to deal with this wide flung problem. Under the direction of such a committee a scheme for research should be framed which would then be submitted to the Council. In his opinion research scholars posted in areas where the diseases chosen for investigation are prevalent and working under the local entomologist would probably meet the needs of the case. If accepted, the scheme would be carried out under the direction of a small standing sub-committee which would act in concert with the Council's Sugar Committee. Dr. Subrahmanyan agreeing with Dr. Gangulee said that the rates of pay proposed were too high. The Council could get well qualified workers for Rs. 350—550 for the first post, Rs. 200 to 300 for the second and Rs. 120 to 220 for the third. Dr. Agharkar said that, in his opinion, an investigation was necessary but that the agency was not suitable in that it was too costly. He favoured Mr. Milne's idea. He also suggested that on such a committee the co-operation of the Forest Entomologist and the Zoological Entomologist should be obtained. In the result the Board rejected the scheme proposed by Mr. Fletcher and recommended Mr. Milne's proposal for the initiation of future research into the Insect Pests of sugarcane to the favourable consideration of the Governing Body.

4. *Report of the Locust Committee : proposals for future research (Subject No. 19 of the Agenda). (Appendix XVIII).*—The Board recommended the report of the Committee to the Governing Body.

5. *Proceedings of the First and Second Meetings of the Indian Oil Crushing Industry Committee appointed by the Imperial Council of Agricultural Research (Subject No. 20 of the Agenda). (Appendix XIX).*—This was for the information of the Board. Noted.

6. *Proposal for the establishment of a Bureau of Information and Statistics and the appointment of Central Committee for oil seeds (Subject No. 21 of the Agenda). (Appendix XX).*—Dr. Gangulee supported the proposal. Mr. Srivastava suggested in modification of the scheme that until a Technical Secretary was appointed there should be employed only a very small clerical staff which could work under the direction of the Agricultural Expert to the Council. The work of the proposed Bureau of Statistics required the services of a Technical Secretary. Dr. Subrahmanyan supported Mr. Srivastava and recommended that, in the interests of economy, the number of the Committee should be reduced from 16 to say 7. Mr. Devadhar asked why the Oil-Seeds Trade should not pay a cess from the proceeds of which the expenditure of the Bureau could be met. The Chairman replied that the intention of the Committee was that the Council should finance the Bureau in its initial stages. If the Bureau proved a success the Trade would be asked to agree to a cess as had happened in the case of the Indian Central Cotton Committee. Mr. Devadhar further enquired why the Committee had been called "Central" The Chairman replied that for the present all that they meant by this word was that the Committee would be an all-India one. Later, possibly, Provincial Committees like the Provincial Cotton Committees would be started. Mr. Mehta, in opposing the scheme, said that the Committee had completely ignored the statistical aspect of the problem. India, as shown by the figures published by the League of Nations Bureau of Statistics,

had not only no monopoly in oil-seeds but that actually places like the Argentine were her competitors even in the Indian market. The export cess was therefore entirely impracticable. What the Oil-Seeds Trade required was not the statistical information which they already possessed and for which they could make enquiries from the Director-General of Commercial Intelligence or refer to the publications of the League of Nations but technological assistance. There was no point in stationing a Technologist at Delhi. He must be stationed at some important centre of the Oil-seeds trade. The Oil Technologist attached to the Harcourt Butler Technological Institute at Cawnpore had, for example, been of immense benefit to the Trade. Dr. Forster and Dr. Gangulee strongly supported Mr. Mehta. At this stage the Chairman suggested that, as the general sense of the Board seemed to be against the proposal, it might be as well to refer the discussion on it to the Oil Seeds Committee for remarks before the proposal was finally rejected. The Board agreed.

7. *Application from the Government of Bengal for the appointment of a cigar curing and blending expert for India and specially for Madras, Bengal and Burma (Subject No. 22 of the Agenda). (Appendix XXI).*—Messrs. Finlow and Milne introduced the scheme. The problem, in so far as Bengal was concerned, was according to Mr. Finlow one of curing. The cultivator did not now need to be taught the best methods of cultivation; that the Agricultural Department had done and was doing and the cultivator was already an expert in it. Nor was it a marketing problem because the bigger firms were only too eager to buy up leaf suitable for cigar manufacture. For example, whereas last year there were only 200 acres under improved cigar tobacco this year the acreage had gone up to 500 and there was no reason why it should not go up to 10,000 in Bengal. Considering that the returns to the cultivator on these 500 acres amounted to as much as Rs. 5 lakhs it was clear that a greatly increased acreage under improved cigar tobacco would be highly profitable to the cultivator. Dr. Coleman, in supporting the scheme, entered a word of warning against making the cultivator too dependent on supplying the big firms. In the matter of cigarette tobacco it had happened that cultivators had grown improved strains of tobacco suitable for cigarette manufacture on the encouragement of big firms who had later for one reason or another found themselves unable to buy the produce. The result was that the cultivators had been left with tobacco which was useful for no other purpose than for the manufacture of cigarettes. Dr. Gangulee said that the problem before them was a commercial one which should be financed by the industrialist. Mr. Mehta strongly opposed the scheme; he took the Board through its various details of the scheme and showed how, in his opinion, it was not a scheme of research but of demonstration. Quoting from Mr. Finlow's letter he stated that for the first year the officer would be chiefly occupied in a preliminary survey and then draw up a programme. A survey, in his opinion, was entirely superfluous as the tobacco trade already possessed all the information which such a survey would elicit. Nor, as far as he could see, was any provision made for the conduct of research. Under the non-recurring items provision had been made for office furniture and for one curing shed in each of the three provinces. He did not see much use for curing sheds without any other equipment for the conduct of research. The staff also was top heavy. Provision had been made for a very expensive officer who would probably not know the language

and who would hardly be in a position to advise the agriculturist. The Madras scheme, on the other hand, was modest and well conceived and he supported it. Rao Bahadur Ananda Rao supported the Bengal scheme and pleaded that indigenous curing required to be assisted. He preferred that both the Bengal and the Madras schemes should be taken together. Mr. Main said that where Mr. Mehta had gone wrong was in thinking that the Bengal scheme was one of demonstration whereas it was really one of research. Mr. Sethi supporting the scheme desired an assurance from Mr. Finlow, which was given, that the services of the Expert would be available for Bihar and that in case Burma fell out of the scheme Bihar would be substituted in Burma's place. Mr. Srivastava, speaking in support of Mr. Mehta, said that he did not agree with Mr. Main that the scheme was one of research and he quoted Dr. Keen at the Advisory Board of June 1931 in support of his contention. He also wanted to know whether the provinces concerned were prepared to go half shares with the Council. Mr. Devadhar at this stage enquired of Mr. Finlow of the total acreage under cultivation for the superior leaf for cigars and the extent to which the average tobacco grower is to be profited by the scheme and whether co-operative effort has been introduced in the matter of the sale of the produce to enable the cultivator to reap the full benefit of the researches. Dr. Agharkar, in supporting Mr. Mehta, stressed the inadequacy or rather the total absence of any provision for research. There were curing sheds *et practerae nihil* ? Dr. Forster also opposed the scheme as not being one of agricultural research. It was a manufacturing investigation with no vestige of agricultural research in it. Mr. Finlow, in replying to the discussion, said that the opponents of the scheme had confused the problem of curing cigarette tobacco with that of curing cigar tobacco. There was no advice available in the latter case. Dealing with the question whether the cost of such an Expert would be a legitimate charge on the funds of the Council he said that this was in no way different *vis-a-vis* the tobacco grower as the Sugar Technologist, whom the Council were financing, was *vis-a-vis* the grower of sugarcane. He admitted that there was unfortunately no mention in the scheme as put forward by his Department about laboratory equipment but he assured the Board that such equipment would be provided by the Bengal Department of Agriculture. Answering the point raised by one of the speakers as to why, if the Curer's appointment was not one of demonstration but of research, as high a provision as Rs. 500 per month under travelling allowance was necessary. Mr. Finlow said that perhaps the estimate, except for the first year, was excessive. In the first year the Expert would have to travel in the various provinces and so the provision under the travelling allowance of Rs. 6,000 was necessary ; for subsequent years however the provision might be reduced.

On a vote being taken the Board recommended the scheme for sanction.

8. *Marketing of Agricultural Produce (Subject No. 23 of the Agenda). (Appendix XXII).*—This subject was postponed till the next meeting of the Advisory Board by which time it was hoped that fuller information on the subject would be available.

9. *Scheme for the improvement of castor crop in India submitted by the Government of H. E. H. the Nizam. (Report of Committee). (Subject No. 24 of the Agenda). (Appendix XXIII).*—Mr. Nizam-ud-Din Hyder, in introducing the scheme, referred to the principles guiding the

giving of grants by the Council and said that the Sub-Committee in allocating the expenditure as between the Nizam's Government and the Council had departed from these principles. The Sub-Committee had recommended that his Government should bear the whole of the non-recurring expenditure *plus* half of the recurring expenditure. The Chairman admitted that Mr. Hyder's contention was correct and explained that the Sub-Committee had been carried away by the flourishing condition of Hyderabad's finances into recommending that the Hyderabad Department of Agriculture should bear a greater share than was due. Now that the point had been raised he agreed that, if the scheme was sanctioned, the Nizam's Government and the Council should bear the cost of the scheme on a fifty fifty basis, *i.e.*, if the Hyderabad Government bore the whole of the non-recurring expenditure this should be taken into account in reducing their liability under recurring expenditure. In the result the Board recommended the scheme for sanction on the basis of the undertaking given by the Chairman.

10. *Appointment of Mr. Kartha for six months to compile statistics showing the comparative efficiency of the different feeding scales adopted in the Military Dairies and of the effects of disease and other necessary factors on dairying efficiency. (Subject No. 29 of the Agenda). (Appendix XXIV).*—Colonel Olver introduced the scheme which the Board recommended for sanction.

11. *Promotion of Scientific research in the Empire. Proposal from the Empire Marketing Board [Subject No. 2 (a) of the Agenda]. (Appendix XXV).*—Dr. Gangulee endorsed the necessity of co-operation and co-ordination in all future programmes of research in the Empire. He also agreed that periodical meetings of accredited representatives of research organisations and scientific specialists should be held and that periodical surveys of the results obtained in particular fields should be undertaken. He desired that problems of sheep breeding be included in the list of problems suggested by the Animal Husbandry Expert, and that problems of alkali soils, desert locust, breeding of beneficial parasites, fruit cultivation, and low temperature research be included in the list of the Agricultural Expert. He was further of opinion that the Empire Marketing Board should help agricultural research in India. Professor Subrahmanyan pointed out the importance of a chain of research stations for Imperial Research. He suggested that the effect of storage on agricultural products, researches on oilseeds, marketing of agricultural produce, standardisation of methods of analysis for manures, fertilisers and feeding stuffs be included as additional problems for investigation.

Mr. Milne was generally in favour of the views of the Empire Marketing Board. He suggested that Punjab was a very suitable place for the location of an empire irrigation station where problems of water requirements of crops including dry farming could be investigated. The Punjab had a staff of irrigation engineers who could help in the work. He further suggested a closer co-ordination of schemes for plant breeding, *e.g.*, cotton breeding. The Empire Marketing Board could also help in marketing products like Indian Hemp, a report regarding which was recently published by the Imperial Council of Agricultural Research. Investigation on containers for fruit, transport of fruit, hard soils, effect of particulations on plant growth, cause of fertility, etc., were suggested as additional problems. It was also suggested that Empire students may be sent to India where facilities available for training were admirable.



Mr. Ware agreed with the proposals in general but wanted more money allotted for animal husbandry work. He considered rabies a very important problem and wanted investigation on it to begin very early. Wool and animal nutrition were suggested as additional problems, one of the substations for which could be profitably located in India.

Dr. Agharkar proposed that a small committee may be appointed to draft a reply on the strength of replies received from members.

The Vice-Chairman said that there was no great hurry in sending a reply to the Empire Marketing Board; it would be quite sufficient if members let him have written answers in about a month's time. On the basis of these notes he would send a suitable reply to the Empire Marketing Board, consulting, if necessary, a small committee of members of the Advisory Board to be appointed for the purpose. This suggestion was agreed to.

12. *Proposals from the Empire Marketing Board, London, in regard to further research in insecticides and fungicides.* [Subject No. 2 (b) of the Agenda]. (Appendix XXVI).—The Vice-Chairman read a note (Annexure VIII to Appendix XXVI) by the Agricultural Expert on the subject and enquired whether members had any objection to the issue of a reply on those lines. Dr. Coleman generally supported Mr. Burt, but wanted questions of the adhesion of fungicides to leaves, and the design of spraying machines to be further investigated. Dr. Gangulee, Dr. McRae, Mr. Hewlett and Professor Subrahmanyan agreeing, it was decided to send a reply to the Empire Marketing Board on the lines of Mr. Burt's note.

13. *The investigation of Indian fish poisons and other Indian forest products for their insecticidal properties.* (Subject No. 3 of the Agenda). (Appendix XXVII).—Dr. Coleman in introducing the scheme pointed out that a number of indigenous forest products had been found to have high insecticidal properties, and could therefore be investigated regarding their use, standardisation, etc. He particularly drew attention to the case of Derris species occurring in Malaya and mentioned *Pongamia glabra* as one of a large number of plants which deserved to be further investigated.

Mr. Plymen supported the scheme as breaking new ground. He remarked on the want of interest shown by most persons in indigenous raw materials for such purposes. Entomologists, for example, always wanted to use standard methods like Kerosine emulsion which were costly.

Mr. Finlow supported the scheme. Mr. Ware in supporting wanted insecticides for ectoparasites of sheep and cattle to be investigated. Mr. Plymen pointed out that soap-nuts can in many cases replace soap as a spreader for insecticides. Colonel Olver, Mr. Milne and Dr. McRae further supported the scheme. Mr. Mehta wanted that the work should be linked with the work on forest products being carried out at the Forest Research Institute, Dehra Dun. Dr. Coleman pointed out that the work should preferably be carried out on the spot. In the end the Board agreed to recommend the scheme.

14. *Application from the Government of Madras for a grant of Rs. 49,930 spread over a period of 5 years for the extension of work on Animal Nutrition in the Madras Presidency* (Subject No. 4 of the Agenda). (Appendix XXVIII).—Rao Bahadur Ananda Rao explained the scheme. Mr. Warth was of opinion that Coimbatore was very favourably situated

for nutrition work. He considered that work on working bullocks at present being done at Coimbatore was very valuable and deserved to be extended. The question of the mineral metabolism of cattle was very important and Coimbatore had done excellent work on this. Colonel Olver heartily supported the scheme. He was of opinion that local problems should be worked out with local breeds of cattle. He thought that the staff proposed was inadequate and suggested concentration on parts (a) and (j) of the scheme. Collaboration with the Central Nutrition Station was very necessary. Incidentally he mentioned that there was a chance of the Central Institute not materialising which would be a disaster. As the staff proposed was not very highly qualified, local stations should deal with limited objectives. Mr. Ware was of opinion that the Board should express its opinions freely although the scheme may have been invited by the Governing Body. He considered the Hosur Scheme vague and was of opinion that no extra staff was needed if no additional animals were going to be purchased. He doubted whether the biochemist at Coimbatore was right in applying the results based on small animals to large animals. The work at Coimbatore should preferably be controlled by Hosur.

Dr. Coleman enquired whether there was any necessity for the substation if the Central Institute was not going to materialise. On being informed that the Institute will continue to exist, he moved the following resolution which was carried :—

“ The Advisory Board in endorsing the Madras Scheme for work on Animal Nutrition, desire to point out the necessity of its close co-ordination with the work of the central research institution for Animal Nutrition. In this connection they wish to emphasize the great importance of continuing the work of that Central Institute.”

The representative from the Punjab supported the scheme.

In replying, Rao Bahadur Ananda Rao said that the results from small animals were found by experiment to be applicable to large animals. He explained in answer to Mr. Ware, what was intended to be done at Hosur with regard to the several items mentioned in the scheme. The staff proposed was quite efficient for the work to be done by them. The work will be controlled directly by senior men. The facilities at Hosur were adequate and co-operation with the Central Institute was complete.

Mr. Warth explained that work at Coimbatore was planned jointly by Mr. Viswanath and himself and that the experiments were arranged jointly by them. Mr. Ramiah was trained at Bangalore and was familiar with his methods. The co-operation between Hosur and Bangalore was very great as the experiments were often carried out by Bangalore men on Hosur animals.

In the end the Advisory Board agreed to recommend the scheme.

15. *Scheme for an economic enquiry into the cost of sugarcane production in the United Provinces, North Bihar, Bombay, the Punjab and Madras. Revised proposals for the carrying out of an enquiry into the cost of production of sugarcane, cotton and rotation crops (Subject No. 11 of the Agenda). (Appendix XXIX).*—Mr. Mehta in introducing the scheme pointed out that it was the result of the Council's own suggestion. The subject was very fully debated at the last meeting of the Advisory Board.

He considered it desirable that a small Committee of Economists and Agriculturists of not more than 6 members be appointed to control the enquiry by the Economist. He further desired to have small Provincial Committees to be associated with the work. Mr. Milne was of opinion that the programme of the enquiry should be laid down by a committee. To a question by Mr. Devadhar the Vice-Chairman replied that the figures supplied by the provincial departments to the Indian Central Banking Enquiry Committee were not very reliable for the purposes of the present enquiry. Dr. Hyder supported the scheme.

Mr. Mehta suggested that if the scheme is approved it may be circulated to the Governing Body for sanction so that the trained personnel on the staff of the United Provinces Economic Bureau which was likely to be abolished soon may be available for purposes of this work. Mr. Milne endorsed the idea. The Board agreed to the scheme. The Vice-Chairman was authorised to nominate 2 or 3 persons on the Sub-Committee to lay down the programme of work.

16. *Resolutions by Mr. K. Hewlett (Subject No. 30 of the Agenda). (Appendix XXX).*—Mr. Hewlett moved for consideration the following resolutions, of which he had given notice :—

- “(i) That this Board considers the retention of the Animal Husbandry Expert a matter of vital importance for the co-ordination and direction of research in animal husbandry and veterinary science.
- “(ii) It recommends that the matter of the retention of the Animal Husbandry Expert should be re-considered by the Government of India.
- “(iii) If his retention is considered impossible in the present financial circumstances then this Board recommends that the cost of his appointment be debited to the research grant of this Council.”

Dr. Gangulee raised a point of order and asked for a ruling from the chair regarding the admissibility of the resolutions, as they did not come under the jurisdiction of the Advisory Board as determined by Section 47 of the constitution. Mr. Hewlett was of opinion that as this was a matter of scientific importance it came within the purview of the Board's powers.

After hearing speakers on both sides the Chairman ruled that the Board having cast on it the duty of giving advice on scientific questions could say that without the help of an Animal Husbandry Expert it would be hampered in tendering its advice on one class of scientific subjects, namely, Animal Husbandry. It was therefore open to it to discuss Mr. Hewlett's resolution.

Resolutions 1 and 2 were carried.

Mr. Mehta considered that resolution 3 was inadmissible. Dr. Gangulee supported him. The Vice-Chairman was of opinion that it was unwise to pass resolution 3. Mr. Hewlett in the end agreed to withdraw resolution 3 with the permission of the house which was granted.

Resolution 3 was then withdrawn.

The Board adjourned to 10-30 A.M. on the 29th January 1932.

28th January 1932.

(Sd.) S. P. AGHARKAR,  
for Secretary.

PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD  
OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH  
HELD AT NEW DELHI ON FRIDAY, THE 29TH JANUARY  
1932.

The following were present :—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, *Chairman*.
2. Rao Bahadur D. ANANDA RAO GARU.
3. Dr. LESLIE COLEMAN.
4. Mr. G. K. DEVADHAR.
5. Mr. R. S. FINLOW.
6. Dr. N. N. GANGULEE.
7. Mr. K. HEWLETT.
8. Mr. NIZAM-UD-DIN HYDER.
9. Mr. P. J. KERR.
10. Mr. T. F. MAIN.
11. Dr. W. McRAE.
12. Mr. D. MILNE.
13. Colonel A. OLVER.
14. Mr. F. J. PLYMEN.
15. Mr. T. F. QUIRKE.
16. Mr. G. T. TAIT.
17. Mr. F. WARE.

Mr. M. S. A. HYDARI, *Secretary*.

The following attended as visitors :—

1. Dr. S. P. AGHARKAR.
2. Mr. F. J. WARTH.

The Board met from 10-30 A.M. to 12-30 P.M. when it dispersed having completed all the items on the Agenda.

2. *Report of the Sub-Committee on the scheme for the establishment of an Agricultural Research Station at Risalewala (near Lyallpur) for the water requirements of crops (Subject No. 25 of the Agenda). (Appendix XXXI).*—Mr. Milne introduced the Report of the Sub-Committee on this scheme. Mr. Main supported the scheme, which he considered to be one of the best which had come up before the Board, particularly in regard to its subject matter. He was very glad to find from the Report of the Sub-Committee that apart from the 100 acres reserved for intensive investigation as laid out by the scheme, 200 acres would be utilised for adopting the results of the Research to the practical conditions under which the Zamindar and the Irrigation Department had to work so that canal water could in future be used more efficiently and economically. Dr. Gangulee supported the scheme. He said that if the present scheme was sanctioned, then this with the Deccan Dry Farming Scheme would mean that the Council would be spending something like 8 lakhs on dry farming research.

Considering the importance of dry farming in India, he did not consider the amount excessive, but he desired that the fullest possible advantage should be taken of this expenditure and towards this end he suggested :—

- (a) that the Punjab, Sind and Deccan should between themselves collate all the relevant literature (Dr. Gangulee referred to the work done at the Wellcome Laboratory at Khartoum) regarding the water requirements of crops, and
- (b) a small consultative committee should be set up to supervise the lay out of the work and there should be comparison of results. Dr. Agharkar endorsed Dr. Gangulee's suggestion, but objected to the Council having to pay a water rate of Rs. 3,000 per annum. As the scheme would be of benefit to the Punjab Irrigation Department also, Professor Agharkar felt that that Department should forego this charge.

In the result the Board recommended the scheme for sanction.

3. *Report of the Fruits Sub-Committee. (Subject No. 26 of the Agenda). (Appendix XXXII).*—Rao Bahadur Ananda Rao, and Messrs. Main, Finlow and Milne each introduced that part of the report of the Sub-Committee which concerned their own province. The Chairman then gave the following figures showing to the Board the extent to which the Sub-Committee had reduced the expenditure on the various provincial schemes :—

The Madras Scheme had been reduced from Rs. 1,72,000 to Rs. 66,000.

The Bengal Scheme from Rs. 95,000 to Rs. 57,000.

The United Provinces Scheme from Rs. 3,91,000 to Rs. 61,000.

The Punjab Scheme from Rs. 21,000 to Rs. 11,000.

There had been no cut in the Bombay scheme which was a very modest one costing Rs. 4,000 only. The Assam scheme had not been considered by the Sub-Committee owing to the absence of any representative from that Province to explain it. Dr. Coleman and Mr. Main said that they had certain points of criticism to make on the programme of research proposed in the United Provinces' scheme, but did not wish to do so in the absence of a representative from the United Provinces (Mr. Mehta who had been attending the Board so far had to leave for his province on the 28th evening). Referring to the Madras scheme Dr. Coleman said that if the Madras Government were unable to provide land for the scheme it might be transferred to Mysore where land was available. If, however, Madras was able to carry on the scheme, he had no desire to submit a separate scheme for Mysore as in his opinion one fruit scheme for Peninsular India was all the Council would at present be justified in helping to finance.

In the result all the provincial schemes were recommended for sanction except the United Provinces and the Assam schemes which were postponed till the next meeting of the Advisory Board to allow representatives of these provinces to be present.

4. *Report of the Sub-Committee on the scheme for experimental work on evolution of machinery for threshing and cleaning wheat in the Punjab. (Subject No. 27 of the Agenda). (Appendix XXIII).*—The Board was not very happy about the recommendation of the Sub-Committee that the Council should be requested to advertise in India, Europe and America inviting firms of standing to send out qualified representatives to study the

subject on the spot and to state what their terms would be for producing suitable machinery. Mr. Devadhar wanted to know if the Kirloskar Brothers had been invited in this connection to offer their terms. Mr. Plymen said that efforts had been made to offer inducement to firms in the shape of prizes, but as that procedure had not succeeded, the Sub-Committee desired to reverse the process by asking firms to state the terms on which they would take up the proposed investigation. Neither he nor other members of the Board felt that much would be gained by the Sub-Committee's recommendation, but there was no harm in trying. Subject to the proviso that no commitments would be made without the matter coming up before the Council, the Board adopted the Report of the Sub-Committee.

5. *Classification of research schemes recommended by the Advisory Board into classes according to importance and urgency in view of financial position. (Subject No. 28\* of the Agenda).*—Colonel Olver stated that out of about 37 lakhs worth of schemes sanctioned by the Council, as much as 29.31 lakhs had gone for agricultural schemes and only 7.96 towards those dealing with animal husbandry. He therefore proposed that the two small animal husbandry schemes, items Nos. 4 and 29, should be given preference. Professor Gangulee suggested the following order of priority :—

1. No. 5 (a) of the agenda.
2. No. 29 of the agenda.
3. No. 11 of the agenda.
4. No. 12 of the agenda.
5. No. 13 of the agenda.

Mr. Milne varied the above as follows :—He would suggest No. 25 first, but although he felt that animal husbandry schemes should be given a high place he would like to give the matter further consideration.

Mr. Main suggested that the Secretariat should circulate a list of the schemes recommended by the Advisory Board at the present meeting to each member of the Board who would note his own order of priority. Mr. Coleman supported the proposal and added that in this list should also be given the schemes recommended at the last meeting of the Advisory Board. Each member would draw up his order of priority on the combined list which would be placed before the next meeting of the Advisory Board. He presumed that a few more schemes would be recommended at that meeting which would be followed after an interval by a meeting of the Governing Body. The next meeting of the Advisory Board would therefore on the basis of the suggestions received and on the schemes recommended at that meeting draw up an order of priority for the consideration of the Governing Body.

The Board agreed to this proposal.

6. The meeting of the Board closed with a vote of thanks to the Chairman, proposed by Mr. Devadhar.

M. S. A. HYDARI,  
*Secretary.*

NEW DELHI,  
*The 29th January 1932.*

## APPENDIX I.

## SUBJECT No. 1.

DECISIONS OF THE GOVERNING BODY ON THE RECOMMENDATIONS  
OF THE ADVISORY BOARD IN JUNE 1931.

(1) *Application from Dr. K. C. Mehta for a grant of Rs. 3,000 for investigations on "physiologic forms" of wheat rusts.—Sanctioned.*

(2) *Application from Dr. K. C. Mehta for a further grant of Rs. 3,500 in connection with his scheme of research into the rusts of wheat and barley.—Sanctioned.*

(3) *Application from Professor Parija, I.E.S., Professor of Botany, Ravenshaw College, Cuttack, for the extension of the present period of his research work on water hyacinth at Cuttack by one year.—Sanctioned.*

(4) *Application from the Dacca University for a further grant of Rs. 1,703 per annum and a capital grant of Rs. 1,038 in connection with the scheme for agricultural research already sanctioned by the Council.*

Rs. 1,038 on account of capital grant sanctioned. Out of the sum of Rs. 1,703 recurring, a sum of Rs. 768 has been sanctioned : the University will arrange to meet Rs. 215 from its budget. Sanction for the remaining Rs. 720 on account of appointment of a laboratory assistant will be obtained at the next meeting of the Governing Body.

(The remaining recommendations are under consideration).

M. S. A. HYDARI,

*Secretary.*

*The 21st January 1932.*

## APPENDIX II

SUBJECT No. 5 (a).

SCHEME FOR THE PREPARATION OF CHEAP SYNTHETIC MANURE  
FROM TOWN REFUSE AND WASTE MATERIALS.

Attention is invited to the attached extract from a letter received from the Director, Indian Institute of Science, Bangalore, No. 9-C-2/7075, dated the 31st July 1931, on the above subject. The original scheme (not printed) received with this letter involved a cost of Rs. 10,920 spread over a period of three years and included, *inter alia*, investigations into—

- (i) the time and method of application of the manure to land with and without addition of artificial supplements, and
- (ii) demonstration of the method of making the manure at various towns and agricultural centres.

At the suggestion of the Agricultural Expert to the Council, both the above items have been omitted by the Director from the revised scheme (enclosure) which has now been received. The revised scheme involves an expenditure of Rs. 4,950 spread over a period of two years.

The scheme is submitted for the consideration of the Advisory Board.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

NEW DELHI ;

The 28th December 1931.

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EXTRACT FROM LETTER NO. 9-C-2/7075, DATED THE 31ST JULY 1931, FROM THE DIRECTOR, INDIAN INSTITUTE OF SCIENCE, BANGALORE, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA.

SUBJECT :—*Application for money-grants to continue researches already begun at the Indian Institute of Science, Bangalore.*

I have the honour to inform you that my Council, at its meeting on Monday, 20th July 1931, authorised me to apply, on its behalf, for grants-in-aid of the following subjects of investigation :—

- (1) Preparation of cheap synthetic manure from town refuse and waste materials. Cost over a period of three years : Rs. 10,920.

2. In support of this application I submit herewith detailed statements (not printed), by Dr. V. Subrahmanyam who, for the past two years, has been in charge of the biochemistry department at this Institute.

3. From these statements it will be observed that much foundational work has been already completed at the Institute on subject (1)..... and that the principal items of the proposed expenditure from the grants now sought will be the salaries of the bio-chemists entrusted with the investigations. Suitably qualified bio-chemists will be available from among the post-graduate



students of the Institute, many of whom have been actually engaged on the preliminary experiments.

4. The bio-chemistry laboratories at the Indian Institute of Science are fully equipped for the types of chemical and biological work involved, and there is an ample area of land available on the spot. Thus the inquiries will not entail much expenditure on apparatus and materials, and will not occasion loss of time to Dr. Subrahmanyam in supervising the field experiments.

5. It is not proposed to remunerate Dr. Subrahmanyam although he is highly qualified for the work, both by his experiments on these subjects at the Institute, and from his having spent two years at the Agricultural Experimental Station, Rothamsted, where he gained the Gold Medal of the Royal Agricultural Society.

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#### ENCLOSURE.

*Scheme for the preparation of cheap synthetic manure from town refuse and waste materials.*

I request that the Council of the Institute will be pleased to move the Imperial Agricultural Research Council to help us with a grant to enable us to extend our investigation on the preparation of a cheap synthetic manure from town refuse and waste materials in general.

In most places in India and elsewhere, refuse is disposed of by being either dumped into pits and allowed to undergo spontaneous decomposition or burnt. The former method has now been generally recognised to be a slow and wasteful process, the final product making a manure of only indifferent value. The major part of the useful matter is lost in the form of gas. Because of the presence of large quantities of domestic waste in undecomposed condition, putrefaction sets in rapidly if proper precautions are not taken. The refuse heap becomes a breeding place for flies and mosquitoes and a variety of worms and insects which turn out to be menaces not only to crops but also to public health in general. The process of incineration although useful in certain big towns is, still, a highly wasteful process. Even under the most favourable conditions the refuse does not burn properly, but only smokes away, the foul odours arising out of it seriously endangering the purity of air for miles around. The fuel value of the refuse, particularly in India, is practically nothing : in fact, large quantities of combustible materials like coal and charcoal have to be added to make them burn.

During the years 1922-24 some attempts were made by Dr. G. J. Fowler and his co-workers, in this Institute, to make suitable composts with the local refuse by aerating it with activated sludge under a variety of conditions. The results, though of considerable academic interest were not so encouraging as to warrant extended application of the method.

It has been observed by a number of workers that organic materials like town refuse prove highly unsatisfactory as manures if their ratios of carbon to nitrogen exceed that of 10 to 1. If that proportion be not made up by suitable additions of nitrogen, (a) the rotting of the manure both in the heap and, later in the soil, slackens considerably and (b) the organic materials instead of adding to the fertility of the soil actually lead to its depression by rendering most of the plant nutrients originally present in the soil unavailable.

The need for chemical starters to make the proportion of carbon to nitrogen adequate and to supply certain mineral ingredients which most organic materials are deficient in has been generally recognised.

During recent years Dr. Fowler and his co-workers at Cawnpore have studied the suitability of a variety of waste materials for making organic manures. They used cow dung, cow's urine and night soil as biological activators and completed the fermentation, anaerobically, in pits.

Without commenting on the details of the different methods cited above, it may be stated that for refuse—particularly from towns, which is a heterogeneous mass containing a large amount of resistant cellulosic materials—the use of chemical or biological starters alone will not be adequate for obtaining a satisfactory final product. Anaerobic processes of decomposition are (a) often wasteful, large amounts of liquid and gaseous matter being formed as bye-products and thereby lost, and (b) liable, except in the hands of experienced scientific workers, to lead to much putrefaction and thereby become sources of nuisance and danger to public health.

The objects of the present investigation were to prepare out of town refuse and waste materials, in general, a cheap but useful manure which will, (a) be formed, in a short period of time, under aerobic conditions in the presence of suitable chemical and biological starters, (b) contain all the nitrogenous and mineral compounds, originally present in or added to it, in readily available form, (c) help indirectly in rendering rock phosphates and other resistant minerals readily available to plant nutrition, (d) be repeatable at all seasons of the year and under various climatic conditions even at the hands of unskilled labourers, and (e) be clean, hygienic and prove, at no time, a source of danger to public health. Some of our preliminary investigations having shown that in the presence of minute quantities of inorganic catalysts like cupric hydroxide biological decomposition of organic matter is greatly hastened, we made a systematic study of the effect of spraying raw or treated sewage on heaps of town refuse, specimens of waste vegetation like *Lantana Camara* after treating them with minute quantities of insecticides and fungicides like cupric hydroxide, bleaching powder, calcium cyanamide, etc. The sprayings were carried out from day to day and the heaps turned over frequently to ensure adequate air supply.

It was observed that as a result of the treatment with the activators, (a) the decomposition of the cellulosic materials was greatly hastened, (b) the sprayed sewage lost its foul odour and the heap developed the pleasant earthy smell generally associated with well rotted organic manure, (c) the development of putrefactive organisms and harmful insects and germination of weed seeds were greatly checked. The rate of decomposition was not influenced by the previous treatment of the sewage, raw sewage being just as efficient as the one which had undergone previous aerobic or anaerobic decomposition. The rotting of the refuse was, however, greatly hastened and the manurial value of the compost considerably enhanced by previous addition of lime, nitrogen and phosphate to the refuse. Among the various activators that were tried, copper has been found to be the cheapest and the most efficient, no more than 20 gms. of commercial copper sulphate and its equivalent of burnt lime being required to treat one ton of refuse.

The synthetic manure thus prepared contains 0.9—1.2 per cent. of nitrogen and about 0.2—0.3 per cent. of available phosphoric acid and thus compares

favourably with the average Indian farmyard manure. It decomposes as rapidly as farmyard manure in the soil and the minute quantities of activators present in it produce no toxic effect on plant life.

Systematic pot and plot trials carried with *ragi* (*Eleusine Coracana*) and French beans (*Phaseolus vulgaris*) have shown that, under the local soil and climatic conditions, the manure is distinctly superior to complete artificials and slightly so to the average farmyard manure. It is somewhat inferior to dry activated sludge, but the latter is very much more expensive and its supply is not equal to the demand.

Further experiments have also shown that the refuse treated with activators, (a) rots effectively, without any foul odour, if mixed with nightsoil and subsequently sprayed with sullage, and (b) each heap can deal with about 300 times its weight of sewage, without showing any putrefaction, though a very much smaller quantity is sufficient to bring about biological decomposition.

Experiments have recently been undertaken to determine, (a) the effect of minute quantities of certain biologically active substances on the decomposition of cellulosic materials, and (b) residual values of synthetic manures prepared from town refuse and waste vegetation.

Further work on the subject will include, (a) standardisation of the technique of treatment so that even unskilled workmen can prepare the synthetic manure on a big scale from the refuse collecting in large cities and waste vegetation collecting in considerable quantities in the countryside, (b) extension of the observations to treatment with trade waste which are rich in plant nutrients but generally difficult to treat by the commoner methods of sewage disposal, and (c) study of methods of preserving the manure so as to avoid losses of plant nutrients during storage.

Regarding the facilities for carrying out the investigation at Bangalore, it may be mentioned that, (a) the bio-chemical laboratories of the Indian Institute of Science, Bangalore, are fully equipped for every type of chemical and biological work, (b) there are nearly two hundred acres of available land whereon the necessary pot and plot trials can be carried out, (c) in addition to the waste materials collecting on the Institute estate, there will also be the different types of refuse articles which accumulate within in the towns of Bangalore and the Civil and Military Station, Bangalore, for work and also for studying the problems relating to the sanitary collection of materials prior to treatment, and (d) we have the advantage of receiving the necessary advice and co-operation of the municipal and the health officers of the two towns mentioned under (c).

The expenses connected with the extension of the investigation may be grouped under the following heads:—(a) apparatus and chemicals for laboratory work, (b) pots, manures and other field accessories, and (c) salary of a competent special officer who will conduct the researches under the direction of the Professor of Bio-chemistry. The expenses relating to (a) and (b), though fairly heavy, can be met from the departmental grants, but we have no adequate provision for meeting (c). It is therefore requested that the Agricultural Research Council may be moved to make a grant enabling us to meet the salary of a bio-chemist who will be on the grade of Assistant (Rs. 175—25—275), with a retiring allowance amounting to 10 per cent. of his total salary, for a period of two years in the first instance.

The following is a summarised statement of expenses for which the grant is sought.—

	1st year.	2nd year.
	Rs.	Rs.
Salary of Assistant Bio-chemist .. ..	2,100	2,400
(Contribution to Retiring Allowance) (10 per cent.).	210	240
Total ..	<u>2,310</u>	<u>2,640</u>

## APPENDIX III

SUBJECT No. 5 (b).

## SCHEME FOR THE CONTINUATION OF STUDIES IN ELECTRO-CULTURE.

Attention is invited to the attached extract (Enclosure I) from a letter received from the Director, Indian Institute of Science, Bangalore, No. 9-C-2/7075, dated the 31st July 1931, in regard to a grant for continuation of studies in electro-culture. The results of preliminary trials on electro-culture carried out in the Institute will be found in the note at Enclosure III.

2. The scheme, which is fully explained in Dr. Subrahmanyan's letter (Enclosure II), to the Director of the Institute, involves an expenditure of Rs. 10,920 spread over a period of three years.

The scheme is submitted for the consideration of the Advisory Board.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

*The 2nd January 1932.*

## ENCLOSURE I.

EXTRACT FROM LETTER FROM THE DIRECTOR, INDIAN INSTITUTE OF SCIENCE, BANGALORE, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. 9C-2/7075, DATED THE 31ST JULY 1931.

SUBJECT :—*Application for money-grants to continue researches already begun at the Indian Institute of Science, Bangalore.*

I have the honour to inform you that my Council, at its meeting on Monday, 20th July, 1931, authorised me to apply, on its behalf, for grants in aid of the following subjects of investigation :—

(2) Continuation of studies in electro-culture. Cost over a period of three years : Rs. 10,920.

2. In support of this application I submit herewith (Enclosure II) detailed statements by Dr. V. Subrahmanyan who, for the past two years, has been in charge of the biochemistry department at this Institute.

3. From these statements it will be observed that much foundational work has been already completed at the Institute on subject..(2)....., and that the principal items of the proposed expenditure from the grants now sought will be the salaries of the biochemists entrusted with the investigations. Suitably qualified biochemists will be available from among the post-graduate students of the Institute, many of whom have been actually engaged on the preliminary experiments.

4. The biochemistry laboratories at the Indian Institute of Science are fully equipped for the types of chemical and biological work involved, and there is an ample area of land available on the spot. Thus the inquiries will not entail much

expenditure on apparatus and materials, and not occasion loss of time to Dr. Subrahmanyan in supervising the field experiments.

5. It is not proposed to remunerate Dr. Subrahmanyan although he is highly qualified for the work, both by his experiments on these subjects at the Institute, and from his having spent two years at the Agricultural Experimental Station, Rothamsted, where he gained the Gold Medal of the Royal Agricultural Society.

## ENCLOSURE II.

LETTER FROM PROFESSOR V. SUBRAHMANYAN, TO THE DIRECTOR, INDIAN INSTITUTE OF SCIENCE, BANGALORE, NO. 150/60, DATED THE 29TH JUNE, 1931.

It is proposed to extend our present investigation on electro-culture and this note presents the more important details of the scheme that is contemplated. It is requested that if the Council of the Institute approve of the idea, they will be pleased to move the Imperial Agricultural Research Council to make a grant towards a part of the expenditure.

The results of investigations carried out in other parts of the world leave little doubt that, under favourable conditions, electro-culture is a potent method of increasing the yield of the soil (*vide* Studies on Electro-culture, Pt. I, Appendix III). It has been reported by a number of workers that, under carefully controlled conditions, (a) early germination of seed, (b) rapid absorption of nutrients from the soil, (c) enhanced photosynthetic activity, (d) stronger and healthier plants, (e) early maturation, and (f) considerably enhanced yields, may be obtained.

The more fundamental principles relating to the electric stimulation of plants have, however, so far remained comparatively obscure. Previous work on the subject having been confined only to temperate regions, the conditions for the successful application of the treatment, under tropical conditions, to indigenous crops have yet to be investigated. The strength of the necessary electrification and the time and duration of its application for a variety of crops have also to be determined. The influence of soil and climatic conditions and the effect of manuring on the treated plants have also to be ascertained. These and the allied subjects are of considerable practical importance.

There are four recognised systems of electro-culture :—

- (a) Methods of seed treatment.
- (b) Discharge from a high tension overhead network on the plants.
- (c) Treatment with high frequency currents.
- (d) Earth currents flowing between two electrodes buried in the ground.

A part of our investigation on (a) has already been completed and has led to findings which hold out promise of being applicable to the malting and the brewing industries [Studies on Electro-culture, Pt. II, Appendix III (Not printed)]. Work on (b) has also been already undertaken by us in collaboration with the Electro-technology Department of this Institute. At the present stage, the experiments have been confined to the use of alternating currents. The equipment

consists of a K. V. A. transformer giving 33,000—22,000 V on the H. T. side, appropriate switches and fuses on the L. T. side, an ammeter, a voltmeter and a watt-hour meter. These have been housed in a hut measuring 10 ft. by 8 ft. by 12 ft. The overhead netting has been put up at the height of 10 ft. from the ground for purposes of safety. One H. T. terminal has been connected directly to the net and the other to a plate buried in the ground. The overhead netting is of No. 19 copper wire and is carried on H. T. insulators. The plots and pots under test occupy an area of 60 ft. by 40 ft. : adjoining that is a control area separated from the experimental portion by a wire net, 12 ft. high to eliminate the drifting of ions. The whole area has been fenced doubly round so as to ensure complete safety.

Vegetation trials have been carried out with (a) *ragi* (*Eleusine Coracana*), (b) *Cholam* (*Androsporum sorghum*), (c) tobacco, (d) lucerne, (e) French beans (*Phaseolus vulgaris*), (f) tomato, (g) onions and (h) sesame—with suitable replications. The following manurial treatments have also been compared :—(a) Farm-yard manure, (b) synthetic farm-yard manure prepared in this laboratory, (c) activated sludge, (d) complete artificials, and (e) no manure, as control. Systematic physiological measurements and chemical analyses of representative specimens have been carried out at frequent intervals.

The results so far obtained have shown that (a) under Indian conditions electroculture treatment is definitely beneficial in the early stages of plant life, and (b) the response is very much more satisfactory in the case of soils treated with organic manures than in those treated with artificials.

Further work on the effects of (a) composition, and (b) dosage of organic manures on crop yields has recently been undertaken.

The observations so far made are highly suggestive and hold out possibilities of the application of the treatment to intensive crop production. Further work along the different lines suggested in our paper entitled 'Studies in Electroculture, Part I' should, however, be carried out *before the different systems of treatment can be placed on sound practical and economic basis.*

The Institute has already borne the cost of the various items of equipment and has defrayed all the working expenses connected with the earlier stages of the investigation.

The stage is now come for the different important aspects of the work to be taken up by a competent special officer giving whole-time attention to the investigation. Since our departmental grant is hardly adequate to meet the salary of such an officer it is requested that the Institute's Council will move the Imperial Agricultural Research Council to make a grant towards such expenses. It is suggested that one special officer who will be a competent biochemist may be appointed in the grade of Assistant (Rs. 175—25—275) of this Institute, with the usual retiring allowance of 10 per cent. of the total salary drawn by the officer. The appointment may, in the first instance, be for three years and subject to extension for a further period if the results warrant it.

No payment is sought for the guidance of the work nor contribution towards the cost of ordinary apparatuses and chemicals to be used up by the special officer. It is however requested that a small annual grant of Rs. 1,000 may be made towards the purchase of special accessories like seed treating troughs, germination chambers, pots, manures, employment of extra labour, routine assistance, etc., which will be required in connection with this investigation.

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The following will be a summarised statement of the grant that is sought in connection with the proposed investigation on electro-culture :—

	1st year.	2nd year.	3rd year.
	Rs.	Rs.	Rs.
Salary of one special officer (Assistant in grade 175—25—275).	2,100	2,400	2,700
+ 10 per cent. Retiring Allowance ..	210	240	270
Working Expenses .. .. .	1,000	1,000	1,000
Total ..	3,310	3,640	3,970

#### ENCLOSURE III.

##### A NOTE ON THE RESULTS OF PRELIMINARY TRIALS ON ELECTRO-CULTURE.

During the Spring and Summer months of 1931, pot trials were carried out with *Ragi*, *Jawar*, French beans, sesame, lucerne, and tobacco, with a view to determine (a) the nature of the individual plant response to electro-culture treatment, and (b) the effect of manurial treatment on the development of electro-cultured plants. The following were the treatments :—(1) the manure (control), (2) complete artificials, (3) farmyard manure, (4) synthetic organic manure prepared in this laboratory, and (5) activated sludge. Each trial was suitably replicated and for each set of electro-cultured plants an equal number of untreated plants were maintained as controls.

The electro-culture treatment consisted in overhead discharge, from a meeting 10 ft. high, at 27,000 V, for two hours a day, immediately before sunrise.

Observations with regard to (a) seasonal conditions, and (b) plant physiological data relating to leaf area, shoot height, tillering, etc., were made systematically. Specimens of plants were removed, from time to time dried and preserved for chemical examination. Depending on the nature of the plant the products were removed or the harvests were carried out and the yields were recorded.

It was observed that the electro-cultured seeds germinated more readily in their respective pots than the controls : the treated seedlings also developed more rapidly, particularly in pots that were manured with activated sludge, farm-yard manure and synthetic manures, all organic manures. The effect was only nominal in the case of the unmanured and artificially manured plants and in fact it was observed later that those plants did not differ appreciably from the controls : such plants also tended to get more readily 'burnt' at the edges of their leaves (probably as the result of the high tension discharge) than those raised on organic manures though the latter were bigger plants and, being nearer the netting, received a greater portion of the discharge.

Among the organic manures, the maximum response was shown to treatment with activated sludge which was in a finer state of division and



contained a greater amount of available nitrogen and minerals than the others. The increased development (as a result of electro-culture treatment combined with treatment with organic manures) was well marked in all the cases but it was most strikingly so in the case of *Jawar* which outstripped the corresponding controls (manured but not electro-cultured) in height by about 1 ft. and in girth by about an inch. In the corresponding case of *ragi*, the electro-cultured plants showed more prolific tillering than the controls: in that of tomato, the treated plants were more bushy and bore more fruits than the controls: in the case of lucerne the electro-cultured plants came to cutting about a fortnight before the untreated ones.

Quantitative observations were discontinued after the first three months as it was observed that there were changes in field intensity at different points as the result of the varied heights of plants. It is hoped to remedy this defect when repeating the trials during the next season.

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## APPENDIX IV.

SUBJECT No. 5 (c).

SCHEME FOR THE EXTENSION OF SEWAGE-FARM INVESTIGATIONS,  
WITH SPECIAL REFERENCE TO PAPAYA AND PLANTAIN CULTIVATION.

Attention is invited to the attached extract (Enclosure I) from a letter received from the Director, Indian Institute of Science, Bangalore, No. 9-C-2|7075, dated the 31st July 1931, on the above subject. The details relating to available facilities and nature of animal experiments intended to be carried out to test the quality of sewage crops will be found in Enclosure III.

2. The scheme, which is fully explained in Dr. Subrahmanyan's letter (Enclosure II) to the Director of the Institute, involves an expenditure of Rs. 18,340 spread over a period of three years. The scheme is submitted for the consideration of the Advisory Board.

T. VIJAYARAGHAVACHARYA,

*Secretary.**The 2nd January 1932.*

## ENCLOSURE I.

EXTRACT FROM LETTER FROM THE DIRECTOR, INDIAN INSTITUTE OF SCIENCE, BANGALORE, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. 9C-2|7075, DATED THE 31ST JULY 1932.

SUBJECT :—*Application for money-grants to continue researches already begun at the Indian Institute of Science, Bangalore.*

I have the honour to inform you that my Council, at its meeting on Monday, 20th July, 1931, authorised me to apply, on its behalf, for grants-in-aid of the following subjects of investigation :—

• • • • •

(3) Extension of sewage-farm investigations, with special reference to papaya and plantain cultivation. Cost over a period of three years : Rs. 18,340.

• • • • •

2. In support of this application I submit herewith (Enclosure II) detailed statements by Dr. V. Subrahmanyan who, for the past two years, has been in charge of the biochemistry department at this Institute.

4. From these statements it will be observed that much foundational work has been already completed at the Institute on subject..(3)...., and that the principal items of the proposed expenditure from the grants now sought will be the salaries of the biochemists entrusted with the investigations. Suitably qualified biochemists will be available from among the postgraduate students of the Institute, many of whom have been actually engaged on the preliminary experiments.

4. The biochemistry laboratories at the Indian Institute of Science are fully equipped for the types of chemical and biological work involved, and there is an ample area of land available on the spot. Thus the inquiries will not entail much

expenditure on apparatus and materials, and will not occasion loss of time to Dr. Subrahmanyam in supervising the field experiments.

5. It is not proposed to remunerate Dr. Subrahmanyam although he is highly qualified for the work, both by his experiments on these subjects at the Institute, and from his having spent two years at the Agricultural Experimental Station, Rothamsted, where he gained the Gold Medal of the Royal Agricultural Society.

#### ENCLOSURE II.

LETTER FROM DR. V. SUBRAHMANYAN, TO THE DIRECTOR, INDIAN INSTITUTE OF SCIENCE, BANGALORE, No. 183/30, DATED THE 9TH JULY 1931.

I request that the Council of the Institute will kindly move the Imperial Council of Agricultural Research to help us with a grant to enable us to extend our present investigations on sewage farming.

Laboratory experiments and vegetation trials carried out by us during the past four years have led to the following important findings :—

- (I) In limited doses (not exceeding 40 per cent. saturation) raw or previously treated sewage undergoes ready decomposition in a well aerated soil. Under the Bangalore conditions, the mineralization proceeds so rapidly that there is no appreciable increase in organic matter even after some months of continuous treatment.
- (II) Among the different types of sewage sludges, the one obtained after intensive bacterial oxidation (activated sludge) decomposes more readily than the others and leads to quicker plant growth and better crop yield than the others.
- (III) Very few crops respond favourably to continuous treatment with undiluted sewage. Some market garden crops show signs of 'lodging' owing to the excessive amounts of nitrogen present in strong sewage: others flourish well in the early stages, but either develop abnormal properties like profuse leafing without flowering or get readily attacked by a variety of bacterial or fungus or insect pests in the later stages.
- (IV) Using undiluted sewage effluent for watering market garden crops, it was found that certain vegetables like cabbage, lettuce and beans are generally favoured while others like brinjals, lady's finger and chillies are invariably not encouraged. Some crops are favoured in certain seasons—generally late spring and early summer—but not in others. Profuse watering with sewage is definitely inimical to all the crops the roots beginning to rot even after short contact with stagnant sewage.

Sewage treated soil requires frequent stirring to provide adequate aeration. Its texture improves with liming, but many of the crops tend to "lodge" after heavy liming. Prolonged fallowing after removal of crop is essential to restore normal conditions in the soil.

- (V) Raw or previously treated sewage undergoes ready oxidation in the soil if diluted sufficiently (1 : 3) with water. Vegetation trials with a variety of grasses, cereals and legumes have shown that consistently favourable response may be expected as a result of treatment with

diluted sewage. Liming helps the decomposition of organic matter but does not appreciably affect plant development. The plants thus treated do not require the addition of either nitrogenous or potassic fertilizers, but respond readily to treatment with superphosphate. The enhanced yields thus obtained correspond to no less than 100 per cent. in favourable seasons, in the case of grasses and as much as 50 per cent. in the case of cereals, tomatoes and lucerne.

Soils treated with diluted sewage have not so far shown any signs of sickness. There is, on the other hand, an indication to show that the organic matter of the sewage is completely destroyed in the soil, so that it appears that sewage has no residual value as a manure.

Systematic physiological observations have shown that the plants raised on diluted sewage function as normally as those raised on any organic manure. Those growing on undiluted sewage—whether previously treated or not—show abnormal vegetative development and considerably depressed reproductive activities.

(VI) Since the beginning of 1928, a sewage farm has been maintained by the Institute to demonstrate the possibilities of raising crops profitably on sewage. All the crops raised on the farm have been kept under observation and among the various items of interest, it may be mentioned that certain trees like the papaya and the plantain flourish better on sewage than many of the market garden crops themselves: they also require less attention.

The foregoing observations made by a number of workers of this department are of considerable practical significance. They show that under carefully controlled conditions, sewage farming is clean and hygienic and can be run along profitable business lines. In view of the encouraging nature of the result so far obtained it is therefore now felt that further study of the subject should be made by a special staff devoting wholtime attention to the investigation. In addition to obtaining more information regarding the various aspects mentioned above, further work should be done to determine whether—

- (a) during land treatment of sewage the different plant nutrients are conserved in the soil or lost by denitrification or otherwise,
- (b) the drainage from the sewage treated soil is (1) innocuous and (2) does not carry away the water soluble nutrients originally present in the sewage,
- (c) (1) it is possible to develop a system of sewage farming, under Indian conditions which will be clean and hygienic and, at the same time, profitable,
- (2) a farm of that type can be run either by the cities concerned or requires constant scientific attention with regard to soil conditions, composition of drainage and conditions of crops, and
- (d) the crops raised on sewage possess the same quality as those on other organic manures or artificial fertilizers. The cooking qualities, the proportions of the different chemical constituents, essential amino acids and vitamins as influenced by the sewage treatment should be determined. The nutritive values of sewage treated crops, as determined by animal experiments, should also be assessed.

Among the various items mentioned above, the last one is the most important and requires careful and systematic study. Most Indian villages, and even many large towns, have no system of sewage disposal. The nightsoil is carted out and dumped in heaps : the sullage is just allowed to run on land and various crops—particularly the market garden ones—raised on it. The vegetables thus raised are sold to the public as wholesome materials and are consumed by the latter in considerable quantities. In view of this and the fact that citizens of such towns suffer generally from diseases associated with putrefactive organisms, it would be of primary importance to determine the extent to which vegetables raised on sewage become the carriers of pathogenic and putrefactive organisms from sewage, in which, of course, they are all known to be present. For the study of the above and the allied problems, the laboratories of the Indian Institute of Science provide almost unparalleled facilities. There are excellent arrangements for the collection and the study of sewage in the raw or treated condition : extensive grounds are available for extended pot and plot experiments : the laboratories are well equipped for chemical and biological studies and for animal experiments. The chemicals and apparatuses required in connection with the laboratory studies, though highly expensive, can be provided free by the Institute. The materials required in connection with the vegetation trials, such as pots, manures, seeds are either already available or can be provided free by the Institute. There is however no adequate provision for payment to a competent staff to carry out the researches. A chemist interested in agriculture and a biochemist interested in nutrition will be required to conduct investigations along the two important lines mentioned above. In addition to the laboratory and the field studies, the officers will have to study, on the spot, the conditions prevailing in certain ill drained cities,—particularly those of the East and West Coasts of South India for the time being—and determine the extent to which the undesirable chemical constituents and microflora of sewage pass into the vegetables raised in those areas. Systematic nutrition studies may also be carried out with such crops if further facilities are available.

It is requested that funds may be provided for (a) the salaries and the retiring allowances of two special officers who will be in the grade of Assistants (Rs. 175—25—275) in this Institute and (b) the expenses connected with visits to different areas and collection of samples for investigation. No payment is sought for the direction of the work by the Professor of Biochemistry of this Institute.

The following will be a statement of the expenses in connection with this investigation for which the grant is sought for three years in the first instance :—

	1st year.	2nd year.	3rd year.
	Rs.	Rs.	Rs.
Salaries of two Assistant Biochemists on Rs. 175—25—275.	4,200	4,800	5,400
Retiring allowances (10 per cent.) of aggregate salary	420	480	540
Travelling expenses and collection of samples	1,000	750	750
<b>Total</b>	<b>5,620</b>	<b>6,030</b>	<b>6,690</b>

## ENCLOSURE III.

*Details relating to available facilities and nature of animal experiments intended to be carried out to test the quality of sewage treated crops.*

Facilities for animal experiments in this department include (1) an animal house, with all the accessories, chiefly for experiments with albinos, (2) a small rabbit run and (3) a pigeon shed. Investigation relating to nutrition, standardization of drugs, etc., are actually being carried out by different workers, with albinos, pigeons, rabbits and guinea-pigs.

The animal experiments proposed to be carried out to test the quality of crops raised on sewage will include the study of (a) growth rates and (b) metabolic changes in some of the animals mentioned above. The crops raised on sewage as well as those raised on unmanured or otherwise treated soil will be fed to animals together with the various items of basal diet. The weights of the individual animals will be followed from day to day and, whenever necessary, the urine and the faeces will be chemically as well as bacteriologically examined.

It is not possible, at this stage, to envisage the nature of the other experiments to be carried out with the animals as they would depend on the way in which the animals, individually and as a whole, will respond to the various treatments.

## APPENDIX V.

SUBJECT No. 5 (d).

## SCHEME FOR EXTENSION OF WORK ON 'QUALITY' IN CROPS.

Attention is invited to the attached extract (Enclosure I) from a letter received from the Director, Indian Institute of Science, Bangalore, No. 9 C.-2|7075, dated the 31st July 1931, on the above subject. The scheme, which is for two years in the first instance and is fully explained in Enclosure II, involves an expenditure of Ra. 5,400.

2. The scheme is submitted for the consideration of the Advisory Board.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

*The 2nd January 1932.*

## ENCLOSURE I.

EXTRACT FROM LETTER FROM THE DIRECTOR, INDIAN INSTITUTE OF SCIENCE, BANGALORE, INDIA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. 9C.-2|7075, DATED THE 31ST JULY 1931.

SUBJECT :—*Application for money-grants to continue researches already begun at the Indian Institute of Science, Bangalore.*

I have the honour to inform you that my Council, at its meeting on Monday, 20th July 1931, authorised me to apply, on its behalf, for grants-in-aid of the following subjects of investigation :—

• • • • •

(4) Extension of work on 'quality' in crops. Cost over a period of two years : Ra. 5,400.

2. In support of this application I submit herewith detailed statements (Enclosure II) by Dr. V. Subrahmanyan who, for the past two years, has been in charge of the biochemistry department at this Institute.

3. From these statements it will be observed that.....the principal items of the proposed expenditure from the grants now sought will be the salaries of the biochemists entrusted with the investigations. Suitably qualified biochemists will be available from among the post-graduate students of the Institute, many of whom have been actually engaged on the preliminary experiments.

4. The biochemistry laboratories at the Indian Institute of Science are fully equipped for the types of chemical and biological work involved, and there is an ample area of land available on the spot. Thus the inquiries will not entail much expenditure on apparatus and materials, and will not occasion loss of time to Dr. Subrahmanyan in supervising the field experiments.

5. It is not proposed to remunerate Dr. Subrahmanyan although he is highly qualified for the work, both by his experiments on these subjects at the Institute, and from his having spent two years at the Agricultural Experimental Station, Rothamsted, where he gained the Gold Medal of the Royal Agricultural Society.

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## ENCLOSURE II.

LETTER FROM PROFESSOR V. SUBRAHMANYAN, DEPARTMENT OF BIOCHEMISTRY,  
TO THE DIRECTOR, INDIAN INSTITUTE OF SCIENCE, BANGALORE, No. 225/30,  
DATED THE 19TH JULY 1931.

I request that you will kindly move the Council of the Institute to approach the Imperial Council of Agricultural Research for a grant to enable us to extend our investigation on 'quality' in crops.

Until recent years, quality in crops was considered to be a vague entity determined to a greater extent by individual taste rather than by any particular difference in chemical composition. With the recent discoveries in the field of nutrition, and in technical operations like malting, brewing and bread-making, it has come to be realized that the apparently negligible differences in composition caused by soil conditions, manuring, variety of seed, etc., to agricultural crops are highly important in assessing either the nutritive values of food materials prepared out of them or their suitability for various technical operations.

The following are some instances to show the importance of quality as distinct from quantity as represented by total yields of crops :—(1) The nitrogen content of the grain is an essential factor in the assessment of the milling quality of wheat and the malting quality of barley. In the former, a high content of nitrogen is essential to attain the desired strength, while, in the latter, a low content of nitrogen is associated with high malting quality. (2) Heavy manuring increases the yield of tubers like potato and mangold wurzel, but the crops thus obtained contain more of water and partially assimilated salts than those raised on unmanured soil and in consequence possess less of (a) keeping quality and (b) feeding value than the latter, and (3) grain and market garden crops raised on certain artificial fertilizers possess about the same chemical composition as those raised on organic manures, but are poorer in vitamins and essential amino acids than the latter.

Although the yield of crop is of primary interest to the farmer, yet the quality of the product is of fundamental importance to the consumer. This would apply particularly to a country like India where defective nutrition is so commonly prevalent. The importance of an investigation on quality, in its various aspects, can, therefore, be hardly over-estimated.

Recent investigations carried out in this department have shown that the malting quality of barley can be considerably improved by electrical treatment. Further work along that and allied lines have already been undertaken and promise to be fruitful.

With a view to obtain an idea of the nature of quality in rice, the staple food of hundreds of millions in India and the East in general, a systematic investigation was undertaken, in this department, in the beginning of 1928, in collaboration with the Paddy Specialist to the Government of Madras. Among the various aspects of the problem proposed to be studied, the following were some of the more important ones :—

1. *The influence of season, soil conditions and manuring on the chemical composition and nutritive value of rice.*—Over 100 specimens of paddy, including all the well-known varieties, grown in different parts of India were examined for their physical attributes, certain chemical constituents and calorific values. Further chemical examination and data from field observations are needed to



finish the investigation. It is expected that the completed study will supply some valuable information relating to the abovementioned aspects of the problem.

2. *The effect of breeding for increased yield on the nutritive value and sustaining power of the grain.*—This aspect of the study was, at the outset, intended to be with special reference to certain peculiar observations made by the Paddy Specialist to the Government of Madras with regard to certain new strains of paddy that were recently introduced in Godavari delta. The new (Aduturai) strains readily adapted themselves to the local conditions and gave increased yields amounting to about 15 per cent., but the ryots particularly the poorer ones soon gave up raising them because the grains obtained from them did not possess sufficient sustaining power. Whereas two meals of rice per day from the old Godavari strains were sufficient to sustain an average man, even three of rice from the new strains were hardly sufficient! The above observation would mean that although the new strain of paddy gives 15 per cent. more yield than the old one, it is actually 30 per cent. less efficient than the latter, thereby suggesting that there is some fundamental difference between the compositions of the two grains.

The calorific values of paddy from the two abovementioned strains as also the ones from the parent strains of the new one have not revealed any striking difference. The difference obviously lies in the chemical nature of the constituents of the two grains and further study has to be carried out to determine the character and proportion of the starches and the proteins of the two varieties of rice.

3. *Duration of growth in relation to composition and quality of rice.*—In the case of the commoner varieties of paddy, the period of lapsing between the germination of the seed and the harvesting of the grain varies from about 90 days to over 280 days. The ryot chooses the short period crop in preference to the long period one in anticipation of either (a) irrigation facilities for two or more crops in a season or (b) unfavourable climatic conditions which might destroy a long-standing crop.

Since the observations of Rosenheim and Kajivra have shown that the rice protein though present in relatively small quantities, possesses a high nutritive value, some experiments were carried out to determine whether the duration of growth made any difference with regard to the protein contents of the grain. The observations showed that such was in fact the case: the grain from the short period crop developed only a nominal fringe of aleurone layer, while that from the long period one had a very much thicker layer: the nitrogen content of the former was about 0.3 per cent. representing about 2 per cent. of protein while that of the latter was over 0.9 per cent. representing about 6 per cent. by weight of that essential food constituent. It would appear, from the above, that although the farmer loses in total yield by raising a long period crop he gains considerably in quality.

The foregoing observations are highly suggestive and deserve to be followed up by further systematic study.

*Effect of storage and parboiling on the nutritive value of rice.*—It is well-known that rice prepared by husking recently harvested paddy (a) cooks rapidly to a shapeless paste and (b) causes digestive disorders on being taken. On keeping for some time, however, the same rice cooks properly and is easily digested.

Parboiled rice, though somewhat coloured, is invariably taken by the poorer classes because the cooked grain (a) keeps well, for considerable lengths of time, either by itself or soaked under water and (b) has greater sustaining power than rice prepared otherwise.

Some light has been thrown on the above by certain recent observations— (a) there is definite biochemical change going on in the grain even after harvest, (b) during parboiling, the protein present in the aleurone layer and on the outer coating of the kernal in general are first peptised by the penetrating water and coagulated on the endosperm of the grain. The coagulated protein forms a thin but inseparable coat of the rice which is obtained in husking. It would therefore appear that the partial cooking during parboiling and the presence of coagulated protein which would otherwise be lost have some relation to the properties of parboiled rice mentioned above. Further work is, however, needed to throw more light on the above and the allied problems which are of considerable practical significance.

The foregoing are but a few instances to show the importance of a systematic investigation on quality in crops with particular reference to rice. Detailed study of some of the problems mentioned above would not only throw light on the nature of physiological response of plants to a variety of conditions but also help, considerably, to modify our present system of agriculture so as to attain quality with quantity.

The laboratories of the Indian Institute of Science provide perhaps the best facilities in India for the conduct of such investigations. The various materials required in connection with the laboratory work and animal experiments can be provided free of cost by the Institute. No payment is sought for the planning and the direction of the work but it is requested that funds will be provided for the engagement of the services of a qualified biochemist who will be in the grade of Assistant in this department and who will devote wholetime attention to the conduct of the researches connected with the investigation. A small additional grant to provide for the retiring allowance of the biochemist and to meet any special expenditure that may arise in connection with the collection of specimens is also sought. The following will be a statement of expenses for which a grant is sought for a period of two years in the first instance :—

Items of expenditure.	1st year.	2nd year.
	Rs.	Rs.
Salary of biochemist in the grade Rs. 175—25—275 ..	2,100 0 0	2,400 0 0
Retiring allowance (10 per cent. of total salary) ..	210 0 0	240 0 0
Towards collection of specimens and other special items	250 0 0	200 0 0
Total ..	2,560 0 0	2,840 0 0

## APPENDIX VI

SUBJECT No. 7.

## APPLICATION FROM LT.-COL. R. N. CHOPRA OF THE SCHOOL OF TROPICAL MEDICINE, CALCUTTA, FOR RESEARCH IN SYSTEMATIC CULTIVATION OF MEDICINAL PLANTS AND STUDY OF FOOD POISONS IN INDIA.

Attention is invited to the attached letter No. 108, dated the 4th January 1932, (Enclosure I), forwarding a scheme for research in systematic cultivation of medicinal plants and study of food poisons in India submitted by Lt.-Col. R. N. Chopra. The recommendation of the Provincial Agricultural Research Committee, Bengal, will be found in Enclosure III. The scheme involves a yearly expenditure of Rs. 12,572.

2. It is understood that during the current year the Indian Research Fund Association has made a grant to the School of Tropical Medicine, Calcutta, of Rs. 21,928 for pharmacological, chemical, physiological and therapeutical researches on indigenous drugs.

The scheme is now submitted for the consideration of the Advisory Board.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

*Dated the 8th January 1932.*

## ENCLOSURE I.

LETTER FROM THE SECRETARY TO THE GOVERNMENT OF BENGAL, AGRICULTURE AND INDUSTRIES DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 108, DATED CALCUTTA, THE 4TH JANUARY 1932.

In continuation of this Department letter No. 7441, dated the 28th December 1931 (not printed), I am directed to forward herewith another scheme (Enclosure II) for research in systematic cultivation of medicinal plants and study of food poisons in India, submitted by Lieutenant-Colonel R. N. Chopra of the School of Tropical Medicine, Calcutta, which has been approved by the Provincial Agricultural Research Committee, Bengal, for inclusion in the agenda of the meeting of the Advisory Board to be held in the current month, together with relevant extracts from the minutes of the committee meeting on the subject.

2. The scheme has been approved by the Government of Bengal (Ministry of Agriculture) on condition that no financial liability devolves on them. One hundred spare copies of the scheme will follow.

## ENCLOSURE II.

Papers relating to Colonel Chopra's Scheme for Research in Systematic Cultivation of Medicinal Plants and Study of Food Poisons in India.

LETTER FROM LIEUTENANT-COLONEL R. N. CHOPRA, I.M.S., PROFESSOR OF PHARMACOLOGY, SCHOOL OF TROPICAL MEDICINE, CALCUTTA, TO THE VICE-CHAIRMAN, IMPERIAL COUNCIL OF AGRICULTURE, SIMLA, (THROUGH THE DIRECTOR, SCHOOL OF TROPICAL MEDICINE, CALCUTTA, DATED CALCUTTA, THE 3RD JULY 1930.

I have the honour to put before the Imperial Council of Agriculture a scheme for research in systematic cultivation of medicinal plants and study of food poisons in India.

2. The subject of cultivation of medicinal plants is important both from medical and economic points of view. India is a veritable emporium of medicinal plants, nearly three-fourths of the drugs mentioned in the British and other Pharmacopœias grow here in a state of nature. The country possesses climatic conditions varying from the coldest to the hottest, so that the drugs which do not naturally grow within her bounds can be easily made to do so. Acclimatisation is possible in India to a large extent with almost any plant, in fact it has been amply proved in the case of digitalis, ipecacuanha, cinchona, jalap, etc., and there is no reason why the country should not grow every drug to supply her own needs if not for export. As matters stand at present, India imports not only large quantities of drug preparations but also crude drugs to the extent of many millions of rupees annually. Vast tracts of land are lying waste at present in India which if utilised for the cultivation of drugs will not only enrich those concerned in the enterprise but will give the people drugs at a reasonable price. A study of the statistics shows that very little is being done at present in this connection. This fact is indeed deplorable. In countries like Germany and Belgium medicinal plants and essential oil gardens have proved a great success. The State in France is taking a great deal of interest in growing drugs on a large scale and in the United States medicinal herbs are being cultivated on an industrial scale and the cultivators are reaping a rich harvest and making large profits. More interest created in this direction in India will greatly be to the advantage of all concerned. In the United States of America there is a bureau of plant industry attached to the Botanical Survey Department of the Department of Agriculture. This bureau sends its agricultural experts to various parts of the world to investigate into the climate, soil and environments suitable for the growth of a particular plant with a view to its introduction in their own country. Even the Commonwealth of Soviet Russia have a bureau for carrying on drug trade. All these departments are carrying on splendid work for the respective countries. Research in this important branch of agriculture will greatly benefit the country.

3. *Food poisons*.—There are a number of food poisons, both of man and animals, about which very little is known. Examples of these are :—

Beri-beri and epidemic dropsy due to diseased rice,

Lathyrism due to *Lathyrus sativus* ;

Loliism due to *Lolium temulentum* ; and

Paspalismus (kodo poisoning) due to *Paspalum serobiculatum* (kodo), a millet,

are known, to occur in India. Besides, there are forage poisons communicated to animals. An investigation into these is very important from an agricultural point of view.

If funds are placed at my disposal I propose to work on the following lines :—

(1) To make a general survey of the medicinal plants which are natives of India and of those which have been naturalised. Most of the surveys done are very old and during the last ten years of my association with research in indigenous drugs I have strongly felt that a fresh survey is absolutely necessary.

(2) To get in touch with the Agricultural Departments and Institutions in different provinces and encourage them to grow suitable medicinal plants.

(3) To analyse the medicinal plants so produced in order to see if their active principles come up to the standard required by the pharmacopœias. In this way it will be possible to determine in what part of the country particular drugs do best.

(4) To test pharmacologically and therapeutically the action of these drugs.

(5) To carry out a systematic investigation of different food and forage poisons occurring in the country.

The following staff in addition to what I have will be required to take up this work :—

	Per mensem.	Rs.
One Botanist at Rs. 250 to Rs. 350 .. ..	.. ..	3,600
One Chemist at Rs. 250 to Rs. 350 .. ..	.. ..	3,600
Two Laboratory Assistants at Rs. 50 each .. ..	.. ..	1,200
Two Lab-boys at Rs. 20 each .. ..	.. ..	480
One Sweeper at Rs. 16 .. ..	.. ..	192
Travelling allowance .. ..	.. ..	2,500
Contingencies, etc. .. ..	.. ..	1,000
	Total .. ..	<u>12,572</u>

All the pharmacological and therapeutic testing of drugs and the investigation of food poisons will be done by myself for which the Council will not have to pay anything. The unit will be housed in the Calcutta School of Tropical Medicine and Hygiene. Not only will it have the direction, advice and resources of the Department of Pharmacology at its disposal, but the collaboration of various experts in other departments of the School as well. I am willing to start this work as soon as funds are placed at my disposal.

D.-O. FROM LIEUTENANT-COLONEL R. N. CHOPRA, I.M.S., PROFESSOR OF PHARMACOLOGY, SCHOOL OF TROPICAL MEDICINE, CALCUTTA, TO R. S. FINLOW, Esq., C.I.E., DIRECTOR OF AGRICULTURE, BENGAL, No. 186, DATED CALCUTTA, THE 2ND OCTOBER 1931.

When I was in Kashmir, you were good enough to write to me about the scheme for research which I put up to the Imperial Council of Agricultural Research. You sympathised with the scheme and said that you would be very glad to collaborate in this investigation. You also suggested that the amount asked for may be cut down. On return from leave I have gone into the matter and I find that the only reduction which I can make is to cut down one laboratory assistant, which will reduce the amount by Rs. 600.

The Imperial Council of Agricultural Research wrote to me a letter (copy of which I am attaching) asking for some further information. I am also sending you copy of the reply I have given to this communication. I understand that the meeting of the Provincial Council is going to be held shortly. I shall be grateful if you will be so good as to put this matter through.

D.-O. FROM THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, TO LIEUTENANT-COLONEL R. N. CHOPRA, I.M.S., PROFESSOR OF PHARMACOLOGY, SCHOOL OF TROPICAL MEDICINE, CALCUTTA, No. 1244|AGRI, DATED SIMLA, THE 6TH JUNE 1931.

Please refer to your letter dated the 3rd July 1930, on the subject of the Scheme for research in Systematic Cultivation of Medicinal Plants and Study of Food Poisons in India.

2. I am to enclose an extract from notes prepared in this office for favour of your remarks.

3. We should also like to have any information on the following :—

(i) The drugs which are at present being imported into India and their marketing.

(ii) The plants regarding which you propose to make a general survey.

4. If you can arrange to get the scheme through the Provincial Research Committee, and the Local Government, by, say, November next, we shall place it before the Advisory Board in January 1932.

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*Extract from the file regarding Lieutenant-Colonel R. N. Chopra's Scheme for Research in Systematic Cultivation of Medicinal Plants and Study of Food Poisons in India.*

2. The reference to food poisons seem to me to be a little inaccurate, unless there is newer work of which I am not aware. I was under the impression that beri-beri was definitely proved to be a deficiency disease, due to the consumption of polished rice without the necessary accessory foods, and not due to any disease, or fundamental fault, in the rice itself. Secondly, lathyrism has been shown, by work carried out by the Howards and the Indian Research Fund Association jointly, to be due mainly to weed seeds which are commonly mixed with khesari (*Lathyrus sativus*) and not to the khesari itself. I do not know what the position is as regards kodo-poisoning. We should like to have the latest facts on these points before putting the matter up to the Advisory Board.

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LETTER FROM LIEUTENANT-COLONEL R. N. CHOPRA, I.M.S., PROFESSOR OF PHARMACOLOGY, SCHOOL OF TROPICAL MEDICINE, CALCUTTA, TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, DATED CALCUTTA, THE 1ST OCTOBER 1931.

I regret your letter No. 1244|Agri., dated the 6th June 1931, was not replied earlier as I was away on leave.

2. With reference to the remarks made in the extract from notes prepared by your office, I have to make the following observations :—

(i) *Beri-beri (epidemic dropsy)*.—It is true that between 1925 and 1928 beri-beri was considered to be a deficiency disease, due to consumption of polished rice without the necessary accessory foods. Since then, however, there has been almost a universal change of opinion and the toxic theory has gained ground. Even Colonel McCarrison, whose work on nutritional diseases is well-known, appears to think that there is probably a toxic factor present. There are three main schools of thought regarding the causation of beri-beri—(I) Bernard of Saigon who thinks that beri-beri is produced by a bacteria which may infect rice or which may infect the patient ; (II) In the Calcutta School of Tropical Medicine, we have done a large amount of research work in support of the theory that beri-beri is produced by eating diseased rice. The disease of the rice is produced by its becoming infected with a bacillus very similar to that described by Bernard ; and (III) Japanese workers, who think that toxins are present normally in polished rice and these cause the disease ; vitamin B has the power of neutralising these toxins.

(ii) *Lathyrism*.—Here also the position is not clear. There are three theories about the causation of this condition—(I) Stockman's theory of the poison being contained in the seeds is believed by us in the Calcutta School of Tropical Medicine. We, however, consider that this poison is only present in the grains which are cut ripe and, therefore, germinate; (II) Howard, Anderson and Simenson, who consider that the poison was due to an adulterant called "Akti" or "Akta" (*Vicia sativa*) from which an alkaloid called *vicine* could be obtained; and (III) McCombie Young working with McCarrison thought that the disease was due to avitaminosis caused by one-sided diet when the people live on *lathyrus sativus*.

A perusal of the above remarks will show that the causation of these two conditions is by no means a settled fact as your office note appears to imply. It is for this reason that research on these conditions is very strongly urged. We in this country are in a most advantageous position to work out the problem and the Calcutta School of Tropical Medicine is particularly fortunate in being situated in the middle of the endemic area of one and near the endemic area of the other.

As regards paragraph 3 of your letter—(1) The majority of the drugs used in the British Pharmacopœia are being imported into India either in crude form or in the form of finished products. The Custom reports do not give details of quantities of each drug imported but a perusal of the table I am attaching will show you that the total value of these amounts to an average of over Rs. 70,00,000 annually, exclusive of such preparations as proprietary and patent medicines, cod liver oil, etc.

I am of opinion that a good deal of this drain could be saved by increasing the production and improving the quality of these drugs, most of which either grow in India in a state of nature or can be made to grow under suitable conditions. This is only possible if an inquiry such as I have suggested is instituted.

(2) As regards the plants about which I propose to make a general survey, I would say that practically all the important plants, whether those used in the western system or in the indigenous systems, will be involved. I shall begin with the important plants used in the British Pharmacopœia first and will then go on to the important drugs of the indigenous systems which are largely used by the people of India, and also those which researches in the Calcutta School have shown to be of proved utility.

I am writing to the Provincial Research Committee to put the scheme through the Local Government as soon as possible.

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*List of crude drugs imported into India.*

1. *Aconitum napellus*.
2. *Aloe chinensis* (aloes).
3. *Anacyclus pyrethrum* (pyrethri).
4. *Anthemis nobilis* (anthemidis or chamomila).
5. *Aretostaphylos uva-ursi* (uva-ursi).
6. *Aristolochia serpentaria* (serpentarii).
7. *Arnica montana* (arnica).
8. *Artemisia maritima* (santonin).

9. *Atropa belladonna* (belladonna and atropine).
10. *Barosma betulina* (buchu).
11. *Carum carui* (carui).
12. *Caryophyllum aromaticum* (cloves).
13. *Cinchona succirubra* (cinchona).
14. *Cinnamomum camphora* (camphor).
15. *Citrullus colocynthis* (colocynth).
16. *Claviceps purpurea* (ergot).
17. *Coccus cacti*.
18. *Convallaria majalis*.
19. *Colchicum autumnale* (colchicum).
20. *Croton eluteria* (cascarilla).
21. *Digitalis purpurea* (digitalis).
22. *Erythroxylon coca* (cocaine).
23. *Euonymus atropurpureus* (euonymus).
24. *Ferula foetida* (asfetida).
25. *Gelisemium mitidum* (gelsimium).
26. *Gentiana lutea* (gentian).
27. *Grindelia camphorum* (grindelia).
28. *Guaiacum officinale* (guaiacum).
29. *Haematoxylon campechuanum* (haematoxyli).
30. *Hamamelis virginiana*.
31. *Hemidesmus sarsaparilla* (sarasaparilla).
32. *Hydrastis canadensis* (hydrastis).
33. *Hyoseyamus niger* (hyoseyamus).
34. *Ipomoea purga* (jalap).
35. *Juniper communis* (juniper).
36. *Krameria argentea* (krameria).
37. *Lobelia inflata*.
38. *Papaver rhoeas*.
39. *Picrosma quassioides* (quassia).
40. *Pilocarpus microphyllus* (jaborandi).
41. *Pimpinella anisum* (anisi).
42. *Podophyllum emodi* (podophyllum).
43. *Polygala senega* (senega).
44. *Prunus serotina* (pruni virg).
45. *Quillaja saponaria* (quilliae).
46. *Rhammus purshianus* (cascara sagrada).
47. *Rheum officinale* (rhubarb).
48. *Strophanthus kombe* (strophanthus).
49. *Taraxacum officinale* (taraxaci).
50. *Urginea scilla*.
51. *Valerian officinale* (valerian).
52. *Viburnum prunifolium* (viburnum).
53. *Psychotria ipecacuanha*.



Table showing the quantity and value of drugs and medicines (excluding chemicals and narcotics) imported into India from 1925-26 to 1929-30.

	1925-26.	1926-27.	1927-28.	1928-29.	1929-30.
<b>QUANTITY.</b>					
Camphor (lbs.) .. ..	2,945	266	320	776	11,869
Cocaine (oz.) .. ..	762	205	398	508	488
Cod Liver Oil (lbs.) .. ..	70,787	49,788	65,670	59,754	58,462
Morphia (oz.) .. ..	529	854	797	1,355	834
Preparation of opium and morphia	..	..	..	..	..
Proprietary and Patent medicines	..	..	..	..	..
Quinine salts (sulphate or bisulphate) .. ..	57,999	56,167	44,455	49,297	47,592
Quinine hydrochloride or dihydrochloride .. ..	9,224	8,886	9,164	9,682	9,821
Other salts (lbs.) .. ..	4,704	6,323	5,080	5,313	6,593
Saccharin (lbs.) .. ..	137	124	1,037	890	3,188
Sarsaparilla and preparation thereof .. ..	..	..	..	..	..
Storax including liquid storax (rose mellas) (lbs.) .. ..	43,362	4,200	89	4,200	8,592
Other sorts of drugs and medicines	..	..	..	..	..
Total drugs and medicines ..	..	..	..	..	..
<b>VALUE.</b>					
Camphor (lbs.) .. ..	Rs. 5,405	Rs. 610	Rs. 869	Rs. 1,797	Rs. 17,381
Cocaine (oz.) .. ..	13,088	6,388	8,649	10,385	7,289
Cod Liver Oil (lbs.) .. ..	1,16,632	79,111	81,411	81,249	70,148
Morphia (oz.) .. ..	13,102	13,307	19,448	22,830	21,343
Preparation of opium and morphia	42,690	78,837	88,746	85,801	75,441
Proprietary and Patent medicines	12,44,325	14,92,904	13,57,526	23,12,712	24,28,660
Quinine salts (sulphate or bisulphate) .. ..	15,43,562	12,16,924	9,46,084	10,49,403	10,19,748
Quinine hydrochloride or dihydrochloride .. ..	3,50,959	2,95,518	2,97,306	3,05,975	3,25,424
Other salts (lbs.) .. ..	1,36,586	1,35,898	1,40,520	1,39,454	1,68,342
Saccharin (lbs.) .. ..	10,274	9,447	17,325	16,510	30,417
Sarsaparilla and preparation thereof .. ..	16,896	10,277	15,985	15,877	20,681
Storax including liquid storax (rose mellas) (lbs.) .. ..	12,049	962	100	1,200	2,500
Other sorts of drugs and medicines	49,64,598	52,94,956	54,48,953	48,54,790	53,41,840
Total drugs and medicines ..	84,70,166	86,35,139	84,22,922	88,97,983	95,29,214

*Note on Professor Chopra's scheme, by Dr. G. P. Hector, Economic Botanist to the Government of Bengal.*

Colonel Chopra proposes—

- (1) To make a survey of medicinal plants, both native and introduced.
- (2) To get the help of the Agricultural Department in growing suitable medicinal plants.
- (3) To analyse the plants so produced.
- (4) To test the pharmacological and therapeutical action of drugs obtained from these.
- (5) To carry out investigations of food and forage poisons, *e.g.*, beri-beri, lathyrism, lolismus, paspalismus.

The items of work in which the Agricultural Department could assist are (2) and (5).

It might be quite possible for the Agricultural Department to arrange to grow on its various farms medicinal plants required by Professor Chopra, provided he supplied the seeds. Such as do not grow in the plains could be grown at Kalimpong. As regards (5), the Agricultural Department is already in a position to supply almost any information required regarding varieties of rice grown in Bengal, and could easily supply samples of rice required by Professor Chopra for his studies of beri-beri.

The same applies to lathyrism, lolismus and paspalismus.

The Agricultural Department could very easily grow the plants responsible for these and supply samples as required. Items (3) and (4) do not concern the Agricultural Department, nor item (1).

Item (1), survey of medicinal plants, could best be carried out in collaboration with the Botanical Survey at Sibpur, and for this the services of a systematic Botanical Assistant would probably be required for a few years.

The scheme seems to me a very practical one, and one in which this department could easily assist, as explained above.

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LETTER FROM THE SURGEON-GENERAL WITH THE GOVERNMENT OF BENGAL, TO THE SECRETARY TO THE GOVERNMENT OF BENGAL, LOCAL SELF-GOVERNMENT (MEDICAL) DEPARTMENT, No. 3060, DATED CALCUTTA, THE 26TH FEBRUARY 1931.

I have the honour to submit, for favour of disposal, the accompanying copy of a letter No. 608, dated the 11th February 1931, and of its enclosure from the Director, School of Tropical Medicine and Hygiene, Calcutta, in which he puts forward a scheme from Lieutenant-Colonel R. N. Chopra, I.M.S., for a grant of Rs. 12,572 for research in systematic cultivation of medicinal plants and study of food poisons in India. I recommend the scheme and accordingly request that it may be transmitted to the Director, Imperial Council of Agricultural Research, New Delhi, as requested therein.

LETTER FROM THE DIRECTOR, CALCUTTA SCHOOL OF TROPICAL MEDICINE AND HYGIENE, TO THE SURGEON-GENERAL WITH THE GOVERNMENT OF BENGAL, No. 608, DATED CALCUTTA, THE 11TH FEBRUARY 1931.

In forwarding herewith a scheme from Lieutenant-Colonel R. N. Chopra, I.M.S., for a grant of Rs. 12,572 for research in Systematic Cultivation of Medicinal Plants and Study of Food Poisons in India, I have the honour to state that the need is an urgent one for a closer co-operation between a botanist and a school such as ours, which is devoted to research on tropical diseases. There are many questions regarding food supplies where it is necessary to have such a department attached to the school. At present I am working on beriberi and epidemic dropsy and have to undertake the study of the classification of the rices, their digestibility, structure and certain diseases that effect the grain. An expert on this subject would be of invaluable help in this investigation. There are, moreover, several diseases that are caused by eating certain grains and pulses. Another very important department is the Pharmacological Department where my colleague, Colonel Chopra, is studying indigenous drugs. Such a department would be invaluable to him in identifying the different samples of drugs. The result of these investigations of Colonel Chopra's are leading to three very important issues :—

(1) That of the indigenous drugs which are known to Western medicine there are Indian species often more powerful, and can easily be grown in India. This would lead to the encouragement of the cultivation of these drugs, so that in time India may be self-supporting in this respect.

(2) There are many substitutes such as bitters, etc., that grow in India, and could be utilised more economically than the more expensive Western drugs.

Finally, there are drugs that are used in Ayurvedic, Unani and Tibi medicine, not known to Western medicine, but are extremely useful in the treatment of diseases.

A botanical section would be a very great help to important researches which are being carried on at the school, and in time will ultimately lead to a good deal of benefit to the country. Such a department will bring together those who are working on medicine with the Agricultural Department and the Botanical Survey of India.

I would, therefore, request you to kindly arrange to have the scheme sent to the Director, Imperial Council of Agricultural Research, New Delhi, through the usual channel, as laid down by that Council, namely, through the Provincial Agricultural Research Committee at an early date.

This may kindly be treated as very urgent.

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Generally, I support the underlying idea in the proposal which is, in its botanical side, to get together a Liaison Department joining medicine with all departments of Government capable of giving help in the cultivation or exploitation of medicinal plants. The idea is good and deserves support. In the circumstances of a Drugs Manufacturing Committee no longer functioning, such a strengthening of the Calcutta School of Tropical Medicine may allow this institution to tackle the work it was once hoped the Drugs Manufacturing Committee could do. Some good may come of it. But I none the less think

that the proposal and the methods need to be clarified. On its botanical side a botanist is proposed—

- (1) To make a general survey of the medicinal plants which are natives of India and of those which have been naturalised.
- (2) To get in touch with the Agricultural Departments and institutions in different provinces and encourage them to grow suitable medicinal plants.

I agree whole-heartedly with (2), for it is not improbable that all the departments interested in plants—Forests, Agriculture, Horticulture and Botanical Survey—could help if the Pharmacological Department could specifically indicate the directions in which help is needed. But I am dubious of the immediate practical value of (1), the so-called medicinal plant survey. We have had this before. We have it in academic lists of plants that vary in their importance to medicine. We could extract it easily enough from half-a-dozen standard works that give us some general information on a multitude of plants without giving us much help regarding the development of any one in India's conditions. I doubt not for a moment that a dozen or twenty or more plants could be grown profitably to medicine and to India, and if the Pharmacological Department could let us have a list of those which its present or to be acquired knowledge of the drug market indicates as likely to repay growing, and can at the same time give us some hope or guarantee of trade sale of our grown stocks, the Departments of Forests, Agriculture, Gardens and Botanical Survey might between them take charge of the twenty or thirty crops or whatever number may be.

I am in complete agreement with Colonel Chopra's method when he argues the economic and makes his proposal stand on its own legs. "It will enrich those concerned and give the people drugs at a reasonable price." My experience here, however, tells me to be wary and that it is easier to be carried away by a sweeping optimism than to get the hard economic facts to justify such optimism. I, therefore, agree at once that what we are asked to grow, or exploit somehow, should offer some chance of paying for itself, which is, I think, the best reason why the list should be restricted.

I should advise letting the survey of Indian medicinal plants be a practical one, finding its impetus in the development of the first twenty selections and the proof that these do pay in India's conditions. But, besides in the Pharmacological Department, a botanist is also wanted at the school to co-operate with workers in other departments and this strengthens Colonel Chopra's proposal.

I have already indicated to Government (in my No. 263, dated the 12th September 1929, to the Director-General, Indian Medical Service) how I thought the Botanical Survey could best co-operate in such work, and we have since then had our offer of help accepted. (A Botanical Survey officer has been deputed to the north-west for the Santonin Enquiry.)

If we can help by putting literature and collections at the disposal of officers of the new Drugs Development Department—so to call it—at the School of Tropical Medicine, or can otherwise co-operate with them in their work, such co-operation may be taken for granted. From the new department I should hope to get advice as to the directions our medicinal plant-growing efforts should take.

In the past I have felt handicapped for lack of such advice, and even when we had produced well and cheaply we have not always been able to dispose of our product.

Colonel Chopra speaks of the import to India of drugs valued at millions of rupees. Some indication of what these are and of their marketing might constitute just the help we require in proving that import is unnecessary and that they can be grown well and profitably in India. For the help that a co-ordinating department, one linking the Medical with producing departments, is likely to give the Botanical Survey. I support Colonel Chopra's proposal. But I would seek to emphasise the importance of the economic and would let a medicinal plant survey grow out of the economic (*cf.* letter No. 263 above referred to). I am aware that this proposal is heterodox, that it can be criticised as putting the cart before the horse, but I take the view that a survey is not the less pure and scientific because it is economic, and our experience proves conclusively that if any results are to be had they will come through specialisation in drug plants.

C. C. CALDER.

*The 12th September 1930.*

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LETTER FROM C. C. CALDER, ESQ., DIRECTOR, BOTANICAL SURVEY OF INDIA, TO THE DIRECTOR-GENERAL, INDIAN MEDICAL SERVICE, NO. 263, DATED SIRPUR, THE 12TH SEPTEMBER 1929.

I have the honour to acknowledge receipt of your letter No. 350/6458, dated the 28th June 1929, and to enclose herewith a list of plants of medicinal value that have had their literature indexed here. This work was undertaken at the instance of the Officiating Director, Botanical Survey of India, while I was on leave, and was at once restricted when I returned and suspended as soon as I could suspend it. I did this because I found myself completely out of sympathy with the method of tackling work of this description, and because I saw an increasing expenditure with no commensurate results in the real development of the medicinal resources of India.

2. The aims of developing such resources in this country can, in my opinion, best be attained by good team work involving the co-operation of officers with pharmacological, chemical, botanical and horticultural qualifications, and I was so conscious of the ease with which the real problems could be side-tracked that I had to take the responsibility of at once stopping the library ledgering work begun. In my opinion this was no substitute for the combined pharmacological, botanical and chemical work that had to be done, and in it lay the danger of delaying the real effort that had to be made if these resources were to gain the attention they deserved.

3. Moreover, if the work was to be undertaken in the manner in which I had confidence, the ledgering of knowledge already acquired would only give the minimum of help in the practical development of the drug resources. No scientific officer in real earnest in tackling the economic development of a single drug plant would have to spend much time reading up the literature of a scientific, quasi-scientific or popular nature in leading English or American journals that ledgering clerks ignorant of other languages, can deal with. He would go straight to work already quite well indexed (or ledgered) in some of the leading German botanical works and would quickly be on the track of the originals of all the published works of real value to his purpose. Having done

this, he would not necessarily be much further ahead as regards Indian products, and the further he went the more would become apparent the little use diffuse ledgering work was. At the same time, the truth that practical results are the outcome of specialization on particular products would force itself home.

4. This is the truth of all the drug development work accomplished by the various departments in India that have engaged in it and, in my opinion, is the index to organisation for further development. I would seek to revise the term "Field Survey" in connection with medicinal plant work,—not that a proper survey of all the medicinal plant resources of India is not overdue,—but because I would seek from the beginning to emphasize the economic side of the work and look for future support in the fact that the part had directly paid for itself.

5. Further, I feel the term "Field Survey" somewhat loose or diffuse and, unless Field Officers of rare capacity are obtained, likely to be confined in meaning to the compilation and publication of lists of plants of various degrees of importance as drug sources with their geographical distribution and prevalence. This would be very useful work, and I should welcome it, but between the fact of geographical distribution and prevalence of a drug plant and the possibility of its economic development or exploitation by collection or cultivation lies the danger of a large unbridgeable gap, and this danger concentration on pure field survey work would hold. This danger can best be avoided by appointing the officer or officers to develop specific medicinal plants and by leaving their initiative and interest to expand their scope of usefulness by undertaking medicinal plant surveys. This wise one can hope to see the more important drug plants tackled first and the bringing of them to market. In short, I would link the purely scientific with the economic by the creation of a self-supporting economic.

6. That there is the possibility of self-supporting industries in drug plants I have evidence enough from the work we are at present doing with them in the Cinchona Department (apart from the production of quinine).

7. But the problem is first of all a medical one or one in which the Medical Store Department or Pharmacological Departments under the Medical Department can combine to give advice on. We want to have the Medical Department's advice from some of its numerous sections as to what medicinal plants we ought to start with and specialize on. The list should be limited in recognition of the fact that a Drugs Department if so called and formed, separate from present departments, will have to be small to start with, and the list should comprise only those drugs for which a constant demand can be guaranteed by Government and in which a constant well-established trade goes on. I mention this, because, in the past, some of us engaged in drug-growing and collection have not been well advised as to the direction our efforts should take, and because loss on this account has occurred. There has been a failure in marketing facilities that, possibly, Medical Stores Department could help us out of. Thus, excess quantities of *Digitalis foelia*, *Lycopodium* spores and *Felix mas*, all more or less perishable products, have been left on our hands through absence of official knowledge or demand or absence of marketing knowledge or facilities. Good production work has gone lost. We should therefore stick at first to what is generally and largely needed and what medical stores can take or put us on to the market for.

8. The compiler of the list to be drawn up for our guidance might see this to keep our difficulties in mind by a judicious selection of standard drug necessities. He should also know what is at present being done in the way of medicinal plant cultivation or collection and where it is.

9. I am aware of only a limited number of drug plants at present being exploited.

10. There are at the Cinchona Departments of the Government of Bengal and India (besides the Cinchonas)—

A. (1) Digitalis, (2) Lycopodium and (3) Ipecacuanha.

B. In the Nilgiris—Digitalis.

C. In the North-West (1) Digitalis, (2) Artemisia (Santonin), (3) Possibly Datura, (4) Scilla and (5) Atropa.

11. But this is a very limited list, and there may well be others receiving attention at some of the provincial gardens or by the Forest or Agricultural Departments and regarding which enquiries would have to be made of these departments and gardens before the list, on which further work should be attempted is drawn up. There are also, of course, large numbers of plant products used in Indian medicine that are getting the necessary attention from traders and Indian practitioners.

12. If the appointment of ledgering clerks or botanical officers engaged in pure medicinal plant survey work is not recommended as the proper way to the development of these resources, it remains to discuss what would be a good organization and how it should be cared for administratively. My view here is that results can only come from team work by medical, chemical, botanical and horticultural officers and that the administrative organization to be successful must recognize the necessity for and take steps to ensure the unison of the work. That this is so is, I think, borne out by the history of the organizations already attempted to look after Drugs work.

13. Although work on Indian medicinal resources predates by a long period Sir George Watts' work for his Dictionary of Economic Products, and much knowledge of these plants and their value to medicine had been gained and recognized by the systems of medicine indigenous to India, it is yet true that Sir George Watts Dictionary work focussed medicinal, chemical and botanical opinion on the immense medicinal resources latent in India and gave a directional impetus to their study.

14. The first conscious organization was largely Sir George Watts' and when the Dictionary came to an end an attempt was made to continue Drugs work by the services of the "Indigenous Drugs Committee." The formation of this committee was an attempt at finding an organisation that could co-ordinate the chemical, botanical and pharmacological work necessary. The Committee had some meaning so long as a Chemist, Dr. Hooper, remained attached to the Economic Section of the Indian Museum, but it never had any power and never functioned satisfactorily, and the subsequent formation of a "Drugs Manufacture Committee" was a tacit admission of the previous failure and recognition of the need for team work.

15. But here again, if one may speak out, the Committee system failed. What was everybody's responsibility was nobody's, and it seems to have been with a feeling of relief that the meetings were postponed *sine die* and that the

responsibility was shuffled back to the Botanical Survey Department unequipped as this was for it. It is wrong perhaps to say that it was shuffled back, for the Officer-in-charge then showed a zeal to harbour it that certainly outran discretion, if one judges by the attempt to attain results in the appointment of ledgering clerks, but in any case back it came through the decay of its proper home—the “Drugs Manufacture Committee.”

16. I cannot help regretting the abolition of the “Drugs Manufacture Committee,” for I should have thought that it was just to such a body properly constituted and given the necessary power that workers in all lines pharmacological, chemical, botanical and horticultural on the medicinal resources of this country would have looked for that co-ordination and co-operation, for that management of team work that is necessary to their effort and that I feel is the key to any advance.

17. The problems are not purely botanical. In my opinion they are not even principally botanical. They are first medical and chemical and these decided, they become combined botanical and horticultural.

18. But if the work is to become the preserve of the Botanical Survey alone, I am quite clear as to the nature of the strengthening required. The aim, I think, should be to make the work pay for itself as quickly as possible, and to this end we need recognition of the fact that we have to import trained horticulturists, there being no horticultural training centre in India.

19. Amongst the limited number of medicinal plants we are at present in practice with I have plenty of problems waiting the trained horticulturist now, and as regards financial results, with one of the drug crops other than Cinchona, we are entering a stage where everything points to operations paying for themselves handsomely, provided always they have the undivided attention of the trained nursery man. This is one of the important drug plants for which a standing demand is assured, and it is such specialization and such work I would seek to extend as the next botanical survey contribution to any scheme for the development of the medicinal resources of this country. In this direction I see results. In the diffuse survey of medicinal plants I see results much less certain. But the problem as a whole has medical and chemical aspects just as important as the botanical and essential to the success of the botanical, and I think it is necessary before we go any further to recognise the whole problem and the interdependence of its parts in any organization for its solution.

20. Perhaps these suggestions may influence further discussion you may initiate. I regret this late reply to your letter. I was unfortunate in missing Colonel Lapsley at Simla last month. I called on him to discuss these questions with him, but found he had gone on tour.

#### ENCLOSURE III.

EXTRACT FROM THE MINUTES OF THE FOURTH MEETING OF THE BENGAL PROVINCIAL AGRICULTURAL RESEARCH COMMITTEE HELD AT CALCUTTA ON SATURDAY THE 7TH NOVEMBER 1931.

- (3) Colonel Chopra's scheme (Enclosure II) for an investigation into :—
- (a) Indian indigenous drugs and the possibility of increasing the supply, not only for home use, but also for export ; and
  - (b) food poisons.



In regard to (a) it was pointed out that a somewhat similar scheme from Madras had been accepted by the Advisory Board in June 1931, but it was agreed that Bengal has numerous facilities for such an investigation, not only in its wide range of climate and altitude, but in the Royal Botanic Gardens at Sibpur; also especially in the School of Tropical Medicine, and in the large hospitals, where ample facilities for pharmacological and therapeutic testing of drugs are always available.

With reference to (b), a large amount of work has already been done at the Calcutta School of Tropical Medicine on *beri beri* in which the conclusion has been reached that classical *beri beri* as a purely deficiency disease does not account for all the symptoms met with, and that there is evidence that certain types of rice develop a definite poison which produces a disease distinct from classical *beri beri*. There is necessity for further investigation in this direction, also in the investigation of the other food poisons mentioned in the scheme, *viz.*, Lathyrism, Lolismus and Paspalismus.

The Committee adopted the following resolution drafted by Dr. Ghosh :—

“That Calcutta is a very suitable centre for carrying out the type of work outlined in Colonel Chopra’s scheme, and in view of the facilities available in Bengal for this research, the Advisory Board of the Imperial Council of Agricultural Research should favourably consider this scheme and, if necessary, decide on the nature of collaboration which is possible between this scheme and the Madras scheme which has already been approved. The Department of Agriculture is prepared to afford all necessary help in any such work done in the province”.

•            •            •            •            •            •

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## APPENDIX VII

SUBJECT No. 6.

## SCHEME FOR THE DEVELOPMENT OF METHODOLOGY IN RURAL RESEARCH SUBMITTED BY THE VISWA BHARATI INSTITUTE OF RURAL RECONSTRUCTION, SRINIKETAN.

Attention is invited to the attached letter (Enclosure I), from the Government of Bengal, No. 7441, dated the 28th December 1931 forwarding a scheme (Enclosure II) for the development of methodology in rural research. The scheme involves an expenditure of Rs. 37,500 spread over a period of three years.

The scheme is now submitted for the consideration of the Advisory Board.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

*The 4th January, 1932.*

## ENCLOSURE I.

COPY OF LETTER FROM THE GOVERNMENT OF BENGAL, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 7441, DATED THE 28TH DECEMBER 1931.

With reference to your letter No. 2573|G., dated the 12th December 1931 (not printed), I am directed to forward herewith a scheme (Enclosure II), for the development of methodology in rural research, which has been submitted by the Viswa Bharati Institute of Rural Reconstruction, Sriniketan, for inclusion in the agenda of the meeting of the Advisory Board to be held in January next. The scheme has been approved by the Provincial Agricultural Research Committee and is recommended by Government (Ministry of Agriculture) subject to the condition that no financial liability devolves on them.

One hundred spare copies of the scheme will follow.

## ENCLOSURE II.

Viswa Bharati Institute of Rural Reconstruction,  
SRINIKETAN.

SCHEME FOR THE DEVELOPMENT OF METHODOLOGY  
IN RURAL RESEARCH.

The main conclusion arrived at by the Royal Agricultural Commission in India, in their Report of 1926, is that in order to achieve any definite improvements in Indian agriculture, the problem of village life as a whole will have to be taken in hand and dealt with comprehensively.

The difficulty, however, in putting this principle, into practice is two-fold : first "*the problem of village life as a whole*" is yet too nebulous and vague to most of us ; and second, the *methods* so far used in analysing this problem of village life are not sufficiently mature and scientific for obtaining significant information.

Attempts in the form of village studies are being made in several parts of India to overcome the first of these difficulties ; but they are not leading us very far because the second difficulty—*viz.*, the absence of reliable methods—has also to be reckoned with.

It is evident that somebody, somewhere, must give their whole attention to the development of methodology itself in rural research ; and since this will profit no one particular organization or Province, but will be of service to the whole of India, the Imperial Council of Agricultural Research is naturally the only organization which can be appealed to for sponsoring such a study.

Generally speaking, such a study will involve the following three distinct phases :

- (1) **Selection of Methods.**—While in India we have progressed very slowly, other countries have gone far ahead in the formulation of method in rural research. America, for example, has developed a very elaborate technique involving the use of complicated statistical formula, diagrammatic representation of facts, and several other processes such as the use of score-cards and spot maps and collection of biographical sketches and short stories obtained from rural people. Each method of this kind brings to light some one or another important phase of village life ; and together they serve in presenting a picture which is far more accurate than any compilation of answers to questionnaires—a picture that gives some real clue for dealing with village people, whether it be popularizing of scientific agriculture or merely gaining of important information.

America, however, is not the only country where such methods are being developed. France favours her own characteristic technique and Germany has her own. In England too there are " regional surveys " being carried out by different organizations and Russia as well as the little countries of South Eastern Europe are all busy in analysing their respective rural problems. Japan and China, too, must be included in this list, for in both of them either Christian Missionaries or their respective Governments have made some valuable studies of village life. If, therefore, a methodology of rural research is to be developed for India, the first step will be (a) to select out of the methods that we already know, those that we think can be usefully applied in India and (b) to start, and keep on collecting a large amount of literature from all parts of the world and analyse it for the selection of other methods that are evolving from day to day.

- (2) **Verification of Selected Methods.**—The methods thus selected from this wide range will have to be applied to rural surveys as well as to specific problems in rural economy in some selected regions in India with a view to finding out whether they do lead to significant conclusions. This work can most easily and profitably be initiated in the region in which the Institute submitting this scheme is situated. The conditions prevailing in the Birbhum District of Bengal are akin to those in the adjoining Province of Bihar and Orissa as also to a large tract embracing parts of Central Provinces, United Provinces and even Central India. After they have proved valuable here they can be tried out in some other typical region as well, and if they are found valuable there also, they will readily be accepted and used by workers in all parts of the country.

- (3) **Evolution of Entirely New Methods.**—It is expected that while we are engaged in selection and application of different methods of analysis, we shall be confronted with problems and situations unique to India. These (aside from the mere handling of different methods) will naturally lead us to evolve entirely new methods of analysing local problems, and we shall thereby add to the *repertoire*, of research methodology as a whole. For example, a vital problem and one more important to rural research in India (with her 5 million villages and varying regions) than to research in other countries is the following: *How to select a typical village for any given region?* A large number of village studies that have been made so far are practically useless because they represent conditions that are peculiar to a particular village and do not apply to the region as a whole. This fact has been generally recognized but no work has yet been done to answer the question scientifically. Similarly there are several other problems\* that are bound to evolve new methods of dealing with them and the analysis of which is a crying necessity.

These three phases of the work will have to be carried on simultaneously and the success in each will depend partly upon that in others. For directing the work we already have on our staff a person, in Dr. Amir Ali, who has had the rare opportunity of studying agricultural research both from the technical and social points of view. Our further needs, therefore, are (i) a staff that can easily be trained in this particular kind of work (ii) sufficient funds to cover travelling expenses in the villages as well as to different parts of India and (iii) sufficient money to cover the expenditure on printing, stationery of various kinds as well as that for subscriptions to important magazines and purchase of bulletins, reports, pamphlets and some important books.

The financial requirements to cover these will be as follows :—

	1st year.	2nd year.	3rd year.
<i>Salaries</i>			
1 Assistant for Statistical work @ 150/- .. .. .	1,800	1,800	1,800
1 Assistant for Field work @ 150/- .. .. .	1,800	1,800	1,800
10 Workers for collecting of materials from villages and helping in compilation, etc., @ 25/- p. m. .. .. .	3,000	3,000	3,000
1 Clerk @ 75/- p. m. .. .. .	900	900	900
<i>Travelling</i> .. .. .	3,000	3,000	3,000
<i>Office &amp; Stationery</i> .. .. .	700	700	700
<i>Contingency</i> .. .. .	400	400	400
	<b>12,500</b>	<b>12,500</b>	<b>12,500</b>

Total for 3 Years 37,500/-

RATHINDRANATH TAGORE,  
General Secretary,  
VISWA BHARATI.

SRINIKETAN,  
November, 1931.

\* Three such problems including the one specified above are being worked upon at the Institute in spite of its lack of funds. They are expected to be complete about January, 1931, and will be sent on as supplements to the scheme if they are ready in time for the meeting of the Advisory Board.

The Viswa Bharati Institute of Rural Reconstruction,

SRINIKETAN.

BRIEF OUTLINE OF ITS GROWTH AND ACTIVITIES.

Dr. Rabindranath Tagore had for a long time loved the village life of India and had cherished the desire to be of service to it. As early as about 1912 he acquired from Lord Sinha of Raipur a piece of property, not far from Santiniketan and adjacent to several villages, which he wished to make into a nucleus from where village life could be studied and developed. This place was given the name Sriniketan and Dr. Nagen Gangulee, who was recently on the Royal Agricultural Commission, was for a time in charge of its establishment, but, due to lack of funds, nothing much could be achieved and the project had almost to be given up. In 1921, Dr. Tagore found in America a young and enthusiastic Englishman, Mr. L. K. Elmhirst, who was not only willing to put his head, heart and hand into the work, but who was able to secure financial assistance on a large scale as well. Thus in 1922, with Mr. Elmhirst as Director, was started the "Agricultural Department" of the Viswa Bharati or the International University.

Soon, however, it was realized that the application of science to agriculture, though absolutely essential, was only a part of what was needed for the development of the villages. The incidence of malaria had a distinct though indirect bearing on low production; the number of persons thrown out on to the land due to decay of cottage industries, was seriously disturbing village economy; primary education was accelerating the drift to the city and several other phases of village life were together forming an almost insurmountable obstacle to agricultural development. The "Agricultural Department" of the Viswa-Bharati therefore, very soon assumed the name and functions of the Viswa-Bharati Institute of Rural Reconstruction.

With the generous financial help of Mr. and Mrs. Elmhirst, and a little from Indian sources, Government and public, the Institute has been struggling against local obstacles—and not altogether without success—for the past ten years. To-day its work is more or less clearly outlined. It does research, it provides for resident teaching and it carries on extension work of various kinds in the villages. The following figures, showing the various sums of expenditure incurred, on the Institute and the allotments for the current year, will give a clearer idea of the size and status which it has now attained:—

	Rs.
(a) Initial donation from Dr. Rabindranath Tagore including lands, buildings, livestock, etc.	70,000
Initial donation from Mrs. E. W. Straight .. ..	1,54,000
Total .. ..	<u>2,24,000</u>
(b) Total Capital Outlay in lands, buildings, etc., since 1922	1,81,019
(c) Total recurring expenditure since 1922 .. ..	3,24,992

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(d) Budget figures for 1931-32 showing excess of expenditure over income in the various departments of the Institute :

	Rs.
Extension Work in villages .. ..	10,000
Rural Research .. ..	8,000
Village Industries and Crafts .. ..	7,000
Agricultural Research and Demonstration .. ..	5,000
Resident Teaching .. ..	4,000
Office and Stationery .. ..	2,500
Maintenance of buildings, stock, etc. .. ..	3,500
General and miscellaneous .. ..	4,000
Annual Capital Expenditure on buildings, new stock, etc. .. ..	6,000
Annual Total .. ..	50,000

Although the Institute has gained considerable reputation during the past ten years, the financial help received from Indian sources has not yet been encouraging. It is, however, hoped that now when, thanks to our friends, Mr. and Mrs. Elmhirst, the foundations of the institution have been firmly laid, the public spirited men of India will take more interest and encourage us by co-operating in our work with confidence.

RATHINDRANATH TAGORE.

SRINIKETAN,  
November, 1931.

## APPENDIX VIII

SUBJECT No. 8.

REPORT\* ON HEMP MARKETING IN INDIA BY T. S. SABNIS, ESQ.,  
I.A.S., LATE HEMP MARKETING OFFICER, IMPERIAL COUNCIL OF  
AGRICULTURAL RESEARCH.

At its meeting held at Pusa in December 1929 the Governing Body accepted the recommendation of the Advisory Board for the employment of a whole time officer for a period of one year to study and report on the conditions under which hemp is handled and marketed in India in order that it may compete more successfully with Italian hemp in European markets. As a result Mr. T. S. Sabnis, Second Economic Botanist to the Government of the United Provinces, was appointed to conduct this enquiry which took eight months.

The report\* of Mr. Sabnis is now for the consideration of the Advisory Board.

M. S. A. HYDARI,

*Secretary.*

NEW DELHI,

*The 15th January, 1932.*

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\*Not printed as an enclosure. Was separately printed as a pamphlet and circulated to members.

**APPENDIX IX.****SUBJECT No. 9.****FACILITIES FOR ADVANCED STUDY AND RESEARCH IN AGRICULTURAL SCIENCE AND COGNATE PURE SCIENCES IN THE UNITED KINGDOM.**

Attention is invited to the attached copy of the pamphlet (not printed) entitled "Facilities for advanced study and research in agricultural science and cognate pure sciences in the United Kingdom" issued by the Ministry of Agriculture and Fisheries, London.

2. The Government of India have been asked to forward any suggestions that they may have to offer for the improvement of the publication in order that it may be of maximum value to the research workers in India who may contemplate a period of study in the United Kingdom. The question has been referred to the Imperial Council of Agricultural Research for consideration.

3. In this connection it may be pointed out that in accordance with the request of the Ministry of Agriculture and Fisheries steps are being taken by the Imperial Council of Agricultural Research to prepare and issue a similar volume for India. The material for the Indian volume has now been received from the Local Governments and Universities in India and is being compiled. Subject to any suggestions received, the model of the English volume will be followed as far as applicable.

The subject is now submitted for the consideration of the Advisory Board.

**T. VIJAYARAGHAVACHARYA,**

*Secretary.*

*The 4th January, 1932.*

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## APPENDIX X.

## SUBJECT No. 10.

PROCEEDINGS OF THE FOURTH MEETING OF THE SUGAR COMMITTEE  
HELD IN DECEMBER 1931.

The Proceedings of the fourth meeting of the Sugar Committee, held in December 1931 (not printed), are circulated for the information of the Advisory Board.

2. The recommendations made by the Sugar Committee on the various items of their agenda have been summarised in the attached statement (Enclosure). The action taken on the recommendations is shown in the last column of the statement.

T. VIJAYARAGHAVACHARYA,

Secretary.

The 7th January, 1932.

## ENCLOSURE.

Statement showing the recommendations contained in the Proceedings of the Fourth Meeting of the Sugar Committee.

Serial No.	Item of Agenda.	Subject.	Recommendation of the Committee.	Action taken.
1	2	3	4	5
1	Item No. 1 of the Agenda.	Decisions of the Governing Body on the recommendations of the Sugar Committee (3rd meeting).	Noted .. .. .	No action required.
2	Item No. 2 of the Agenda.	Co-optation of Lala Hari Raj Swarup, M.L.A., as a member of the Committee.	Recommended .. ..	Lala Hari Raj Swarup informed accordingly.
3	Item No. 3 of the Agenda.	Mr. Wynne Sayer's Report on the Imperial Sugar cane Research Conference.	The report was recorded ..	The official report of the conference is awaited.
4	Item No. 4 of the Agenda.	Scheme for an economic enquiry into the cost of sugarcane production in the United Provinces, North Bihar, Bombay, the Punjab, and Madras.	The Committee was of opinion that this work as a piece of fundamental research is of very great importance and should be proceeded with immediately. It was agreed that we should co-operate with the Indian Central Cotton Committee in this investigation, as to get actual costs of cane-growing, it was necessary to find out the cost of crops grown in rotation with cane and cotton. We ought to go on with our enquiry and include crops in rotation provided we have not to pay more than what has been previously proposed in this connection. The control of the joint enquiry should rest with the Vice-Chairman to whom should be left the actual details regarding the shares of the cost to be borne by the Imperial Council of Agricultural Research and the Indian Central Cotton Committee.	Discussed with the Indian Central Cotton Committee and placed before the Advisory Board, vide Subject No. 11 of the Agenda, January 1932 meeting.

*Statement showing the recommendations contained in the Proceedings of the Fourth Meeting of the Sugar Committee—contd.*

Serial No.	Item of Agenda.	Subject.	Recommendation of the Committee.	Action taken.
1	2	3	4	5
5	Item No. 5 of the Agenda.	Report of the Indian Tariff Board on the Sugar Industry.	The recommendations of the Tariff Board were endorsed, special emphasis being laid on certain points.	Extracts sent to the Departments of the Government of India concerned.
6	Item No. 6 of the Agenda.	Mr. Noel Deerr's note on research work in the cane sugar industry.	The Committee desired to thank Mr. Noel Deerr for his very valuable note and desired to circulate it to Provincial Directors of Agriculture.	The note has been circulated accordingly.
7	Item No. 7 of the Agenda.	Application of Mr. A. R. Srinivasa Rao for conducting certain experiments in sugarcane.	This was not accepted as it was not considered to be either a research project or a scheme of experimental work.	Placed before the Advisory Board, vide Subject No. 16(b) of the Agenda, January 1932 meeting.
8	Item No. 8 of the Agenda.	Scheme for the establishment of a Sugarcane Research station in the Punjab.	Recommended for sanction subject to certain amendments.	Placed before the Advisory Board, vide Subject No. 14 of the Agenda, January 1932 meeting.
9	Item No. 9 of the Agenda.	Scheme of research on sugarcane in the Madras Presidency.	Approved of the expansion of the Anakapalli research station and of the provision of a sub-station, but desired the question of site of the latter to be more fully examined.	Placed before the Advisory Board, vide Subject No. 16(a), January 1932 meeting.
10	Item No. 10(a) of the Agenda.	Application from the United Provinces Government for a grant of Rs. 1,76,810 for investigation into the problem of sugar industry in the United Provinces.	Recommended for sanction subject to certain modifications and conditions.	Placed before the Advisory Board, vide Subject No. 15 of the Agenda, January 1932 meeting.
11	Item No. 11(a) of the Agenda.	Scheme for conducting research work on the genetics of the sugarcane at the Imperial Cane-Breeding Station, Coimbatore.	Approved subject to certain modifications.	Placed before the Advisory Board, vide Subject No. 12 of the Agenda, January 1932 meeting.
..	Item No. 11(b) of the Agenda.	Application from the Government of His Highness the Maharaja of Mysore for a grant of Rs. 21,000 spread over a period of five years for the breeding of thick canes.	Recommended .. ..	Placed before the Advisory Board, vide Subject No. 13 of the Agenda, January 1932 meeting.

*Statement showing the recommendations contained in the Proceedings of the Fourth Meeting of the Sugar Committee—contd.*

Serial No.	Item of Agenda.	Subject.	Recommendation of the Committee.	Action taken.
1	2	3	4	5
12	Item No. 12 of the Agenda.	The open pan system of white sugar manufacture. Report of experiments conducted under the auspices of the Imperial Council of Agricultural Research.	(1) The Report should be published substantially as compiled. (2) The Bhopal Durbar and K. B. Saiyad Muhammad Hadi should be thanked for their assistance in connection with this experiment. The Committee also wished to convey their thanks to Mr. Har Sahai Gupta. (3) Rs. 4,000 should be placed at the disposal of the Sugar Technologist for testing and demonstrating his improved <i>bet</i> during the present sugarcane season. The trial is to be carried out at Cawnpore by the Sugar Technologist. (4) A short pamphlet based on the Bilari Report should be printed in Urdu and Hindi.	Action being taken.  This has been done.  The Governing Body has been addressed for the required sanction.  Mr. Srivastava is arranging for this to be done.
13	Item No. 13 of the Agenda.	Scheme for a Research and Testing Station for the indigenous system of gur and sugar manufacture, drawn up by the Sugar Technologist, Imperial Council of Agricultural Research.	Subject to the budget details being scrutinised by the Vice-Chairman, the scheme was approved. It was agreed that the Committee's support to the scheme was conditional on the United Provinces Government's cordial approval, and to certain other conditions being satisfied.	Placed before the Advisory Board, <i>vide</i> Subject No. 17 of the Agenda, January 1932 meeting.
14	Item No. 14 of the Agenda.	Sugarcane Insect Pests (including the carriers of Mosaic) scheme for work at Pusa.	The sense of the meeting was that the expenditure proposed should not be incurred.	Placed before the Advisory Board, <i>vide</i> Subject No. 18 of the Agenda, January 1932 meeting.
15	Item No. 15 of the Agenda.	Interim Report on the Improved Cane Crushing mill at Dacca.	The Sugar Technologist should be asked to get in touch with the makers of the mill and to arrange for a test.	The Sugar Technologist addressed accordingly.
16	Item No. 16 of the Agenda.	Grant of Rs. 8,000 for experiments in devising a satisfactory small-power sugarcane crushing mill in the Punjab, United Provinces and Bihar and Orissa.	Further trials in this connection should be arranged in consultation with the Sugar Technologist.	This will be suggested to the Local Governments concerned.
17	Item No. 17 of the Agenda.	Representation from Messrs. Begg Sutherland & Co., Ltd., Cawnpore, on the increasing difficulties encountered by sugar factories, etc., in India in finding an outlet for their production of molasses etc.	The sub-committee consisting of Messrs. R. C. Srivastava, Noel Deorr, F. Millar and F. A. Sherwani should go into the question and report at the next meeting of the Sugar Committee on the Memorandum presented by Messrs. Begg Sutherland & Co.	No present action. Will be placed again before the next meeting of the Sugar Committee.

*Statement showing the recommendations contained in the Proceedings of the Fourth Meeting of the Sugar Committee—concl'd.*

Serial No.	Item of Agenda.	Subject.	Recommendation of the Committee.	Action taken.
1	2	3	4	5
18	Item No. 18 of the Agenda.	Note by the Sugar Technologist, Imperial Council of Agricultural Research regarding the import and sale of Russian Beet Sugar.	This was read but no action was to be taken on the suggestion made by the Sugar Technologist.	No action required.
19	Item No. 19 of the Agenda.	Memorandum by Mr. S. Ernest Devlal, Cawnpore, on sugar industry in India.	Recorded .. ..	No action required.
20	Item No. 20 of the Agenda.	Geological and chemical survey of the soils of sugarcane growing area.	The information collected was recorded, the Sub-Committee dealing with research schemes to bear the discussion in mind.	Noted.
21	Item No. 21 of the Agenda.	Demand for Brown Sugar.	The Committee felt that they had not sufficient data before them and it was eventually decided to ask the Sugar Bureau to collect information with regard to the relative prices of <i>Khandasari</i> and Java Sugar.	The Sugar Bureau has been addressed accordingly.

## APPENDIX XI

SUBJECT No. 12.

SCHEME FOR CONDUCTING RESEARCH WORK ON THE GENETICS OF  
THE SUGARCANE AT THE IMPERIAL CANE-BREEDING STATION,  
COIMBATORE.

Attention is invited to the attached letter and enclosures (Enclosures I to III), from the Government of India in the Department of Education, Health and Lands, No. 1802-Agri., dated the 23rd November 1931 regarding a scheme for conducting research work on the genetics of the sugarcane. The scheme was considered by the Sugar Committee at their meeting held at New Delhi on the 7th December 1931 and approved by them (Enclosure IV).

The scheme is now submitted for the consideration of the Advisory Board.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

*The 2nd January, 1932.*

## ENCLOSURE I

COPY OF LETTER FROM THE UNDER SECRETARY TO THE GOVERNMENT OF INDIA, DEPARTMENT OF EDUCATION, HEALTH AND LANDS, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 1802|AGRI., DATED THE 23RD NOVEMBER 1931.

I am directed to forward a scheme (Enclosure III) submitted by the Imperial Sugarcane Expert for conducting research work on the genetics of the sugarcane at the Imperial Cane-breeding Station, Coimbatore, together with a copy of a letter (Enclosure II) from the Director, Imperial Institute of Agricultural Research, No. 8012, dated the 9th November, 1931. The Government of India approve the scheme which, it will be seen, involves an annual recurring expenditure of Rs. 7,400 and is intended to run for a period of five years in the first instance. In the ordinary course, the Director, Imperial Institute of Agricultural Research, would have been directed to forward the scheme to you with the request that it should be placed before the Imperial Council of Agricultural Research, with a request that a grant should be made to meet the cost. It is, however, understood that a meeting of the Imperial Council of Agricultural Research Sugar Committee has been convened at the beginning of next month and, in order to save time, I am to forward the scheme direct and to ask that the decision of the Council on the subject may be communicated to the Government of India in due course.

## ENCLOSURE II

COPY OF A LETTER FROM THE DIRECTOR, IMPERIAL INSTITUTE OF AGRICULTURAL RESEARCH, No. 8012, DATED THE 9TH NOVEMBER 1931.

I have the honour to forward for the consideration of the Government of India a scheme (Enclosure III) submitted by the Sugarcane Expert for conducting research work on the genetics of the sugarcane at the Imperial Cane-breeding Station, Coimbatore, to be financed by the Imperial Council of Agricultural Research.

2. The scheme, which has my full support, involves an annual recurring expenditure of Rs. 7,400 as detailed below and is intended to run for a period of five years in the first instance:—

		Rs.
(1) One Geneticist @ Rs. 300—20—600 .. .. .	Average	525
Provident Fund .. .. .		50
	Rs. 575 × 12 =	6,900
(2) Lump sum provision for equipment, etc. .. .. .		500
	Total ..	Rs. 7,400

3. Should the scheme meet with the approval of Government, I would suggest its being forwarded direct to the Imperial Council of Agricultural Research to enable the Council to place it before the meeting of the Sugar Committee to be held on the 7th December, 1931.

#### ENCLOSURE III.

##### *A scheme for conducting research on the genetics of the Sugarcane.*

The present staff at my Station are wholly engaged in the admittedly useful work of breeding improved seedlings for every part of India. In view of the practical results already obtained and the need and demand for more improved canes, it is not desirable—even if practicable—to take off any of the staff for other work. At the same time, I feel that work on the genetics of the sugarcane is vital for placing sugarcane breeding in India on a sound and sure basis. Because of the wide range of conditions that sugarcane breeding in India has to cater for and certain climatic handicaps associated with the location of the bulk of the Indian cane area within the sub-tropics, sugarcane breeding at Coimbatore needs the full resources available from recent advances in the science of breeding. In recent years, the study of crops on the genetical side has assumed great importance and other cane countries have started work on this important aid to cane breeding by the addition of geneticists to their staff.

2. I have the honour to request you to be so good as to kindly approach the Imperial Council of Agricultural Research for a grant to add to my Station, for a period of five years, in the first instance, the post of Geneticist. The appropriateness of the necessary grant being made by the Imperial Council would be evident from the following considerations:

- (i) The work will be useful to the whole of India, as Coimbatore is the only Station supplying seedlings to every part of India.
- (ii) The grant does not involve any expenditure on land and buildings both of which are available at the Sugarcane Station, Coimbatore.
- (iii) The grant is likely to make Coimbatore better able to supply new seedlings to the chief sugarcane provinces, to most of which the Imperial Council has already made grants, the testing of Coimbatore productions forming one of the important items in these schemes. Certain of these provincial schemes, for example, those for (1) Shahjahanpur in the United Provinces, (2) Sugar Research Station in Bihar and (3) Grant for testing Coimbatore seedlings at Dacca, are directly dependent upon the quality and quantity of

new and improved canes available from Coimbatore, and there are other similar schemes awaiting consideration.

- (iv) Coimbatore is very suitable for carrying on work of this nature because of (1) the very wide range of types available at the Station, (2) the fact that Coimbatore has used the largest number of wild species of *Saccharum* in crossing with sugarcane and (3) the interesting intergeneric crosses between Sugarcane and *Sorghum* now in progress. This last piece of work has been characterised by Kew as covering a wider gap between genera than the previously recorded intergeneric crosses.

3. For satisfactorily doing the work a fully trained Geneticist with fairly long experience of such work and thoroughly conversant with the latest developments in cytological technique will be needed. The success of the work depends entirely on the individual selected. As the person recruited will need to carry on the work more or less on his own account, a post in class II Service is needed. As to scale of pay, I would suggest the Class II grade at Pusa below the efficiency bar, *viz.* Rs. 300—20—600, but would strongly urge that the Public Service Commission be empowered to start the candidate at any stage in the grade according to his qualifications and record of work done.

4. If and when appointed, the Geneticist will have available to him the full use of my Station laboratory and its equipment. A lump grant of Rs. 2,500 for the five year period will be needed for any further equipment to my laboratory and for engaging an extra laboratory boy if need be.

5. After the considerable emphasis by the Indian Tariff Board on the need for spending more on Sugarcane Research in India, I take it, no reasons need be elaborated in justification of this grant.

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#### ENCLOSURE IV.

EXTRACT OF PARAGRAPH 12 FROM THE PROCEEDINGS OF THE 4TH MEETING OF THE SUGAR COMMITTEE OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, HELD AT NEW DELHI ON MONDAY, THE 7TH DECEMBER 1931.

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12. *Scheme for conducting research work on the genetics of the sugarcane at the Imperial Cane-Breeding Station, Coimbatore.*

Rao Bahadur Venkataraman's scheme was approved with the following modifications :—

- (1) That the Geneticist should be a Cytologist with training in genetics on a pay of Rs. 400—20—500.
- (2) That the lump sum provision of Rs. 2,500 for equipment should be made to be available as required and not by instalments of Rs. 500 annually. Dr. McRae expressed doubts as to whether the equipment was sufficient but Rao Bahadur Venkataraman explained that he had stated his minimum requirements and in case more funds were needed in this connection he would come up again.

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## APPENDIX XII.

SUBJECT No. 13.

## APPLICATION FROM THE GOVERNMENT OF HIS HIGHNESS THE MAHARAJA OF MYSORE FOR A GRANT OF RS. 21,000 SPREAD OVER A PERIOD OF FIVE YEARS FOR THE BREEDING OF THICK CANES.

At their meeting held at New Delhi on the 8th December 1931 the Sugar Committee of the Imperial Council of Agricultural Research considered the application (Enclosure I) from the Government of His Highness the Maharaja of Mysore and recommended (Enclosure II) it for sanction. The scheme involves a recurring expenditure of Rs. 3,600 and a non-recurring expenditure of Rs. 3,000 making a total of Rs. 21,000 spread over a period of five years.

The scheme is now submitted for the consideration of the Advisory Board.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

NEW DELHI,

*The 31st December 1931.*

## ENCLOSURE I.

## NOTE ON A SCHEME FOR THE BREEDING OF THICK CANES.

The climatic conditions prevailing in the Mysore plateau are admirably suited to work on the breeding of thick sugarcane varieties suited to tropical India. We have had a very large number of cane varieties both indigenous and imported under observation for the past twenty years and the great majority of them have been found to flower and set seed with great regularity. Work on the breeding of thick canes was started by Dr. V. K. Badami, now Economic Botanist to the Department of Agriculture, as long ago as 1912; as no special staff could be provided to carry on the work, it has had to be confined to small dimensions. Even under these conditions a number of seedling canes of great promise have been developed. Some of these, notably H.M. 544, H.M. 320, H.M. 553 and Babbur Striped (a striped bud variation from H.M. 544) have spread over large areas in the State and have in some of our best sugarcane areas, almost entirely replaced the indigenous canes. Yields of 60 tons of cane or 6 tons of jaggery to the acre have been registered with H.M. 320 with an application of manure much below that which is common in the heavy yielding areas of Bombay Presidency. Although these canes have not been specially advertised, some of these (not the best) have found their way outside the State into different portions of Bombay where they are reported to be competing successfully with local high yielding canes. Some of the seedlings, obtained from a rich and high yielding local cane (Pattapatti), during the past three or four years, have shown a vigour combined with comparatively high sucrose content which far surpasses anything we have seen heretofore.

The conditions for the development of testing and propagation work on seedling thick canes have greatly improved within the last year. The Mysore Government have recently sanctioned the establishment of a farm of 600 acres under the Irwin Canal which will be largely devoted to sugarcane cultivation to meet the needs of the 120,000 acre tract which is to come under irrigation. This will allow for comparative trials of promising seedlings on a large scale and I believe that Mysore is in a position to contribute very materially to the improvement of thick canes in tropical India.



The work at present is greatly hampered by lack of staff and under present conditions, it will be impossible for the Mysore Government to meet our requirements in this regard. Our main requirements are two trained assistants to work under Dr. Badami on intensive breeding work in the raising of seedlings from the large amount of material available (more than 70 different cane varieties) and from crosses between the more promising of these. Another promising line of work which we are anxious to take up is that of attempting to produce new varieties by the action of X-Rays on buds and flowers of sugarcane. As far as I am aware, no work of this kind has been as yet attempted in India, but work elsewhere on other plants has yielded very interesting results. During my recent trip to Java, I had the opportunity of seeing new strains of tobacco produced on the Klaten Experiment Station by means of X-Ray action which held out great promise of practical results, while the use of X-Ray in inducing variation in crops reproduced from seed seems likely to yield interesting and valuable results. It would seem that a plant such as sugarcane which is regularly reproduced vegetatively is likely to yield practical results much more rapidly. I may say that on both the farms where it is proposed to concentrate breeding work, *viz.*, Hebbal Farm where the raising of seedlings now in progress should be expanded and the Irwin Canal Farm which will be devoted largely to sugarcane, we shall have electric power which will enable us to carry out this work.

The work which we are undertaking in Mysore has already benefited areas outside the State and should be, I believe, of great value to all parts of India where thick canes can be profitably grown. A scheme to provide assistance in this work is therefore, I submit, one which should receive the sympathetic consideration of the Imperial Council of Agricultural Research. I may say there is no thought of attempting to supplant the work being done on thick canes at Coimbatore but we wish simply to supplement that work. The question of sugar in India is, in my opinion, of sufficient importance to warrant sugarcane breeding work being attempted in more than one place. The plan of the work which it is proposed to take up is given in the following note on Sugarcane Breeding in Mysore prepared by Dr. V. K. Badami, Economic Botanist to the Department.

The requirements to carry out a scheme of breeding on the lines indicated are as follows :—

The additional staff and equipment required for the extension of Sugarcane Breeding Work in Mysore.

(The scheme is for 5 years in the first instance.)

	Average per year.	Total for five years.
	Ra.	Ra.
One Senior Assistant on 150—20—230 .. .. .	2,280	11,400
One Assistant on 70—10—110 .. .. .	1,080	5,400
X-Ray apparatus .. .. .	..	3,000
Other expenses during five years .. .. .	..	1,200
<b>Total .. .. .</b>	<b>..</b>	<b>21,000</b>

If the total expenditure is spread over five years, it will be Rs. 3,600 per annum recurring and non-recurring Rs. 3,000 in the first year.

As far as land, labour and supervision are concerned, the present budget allotment provided for the Hebbal Farm is sufficient for the present.

LESLIE C. COLEMAN,

*Director of Agriculture.*

## SUGARCANE BREEDING WORK IN MYSORE

BY

DR. V. K. BADAMI, L. Ag., Ph. D. (CANTAB.),

*Economic Botanist, Mysore Department of Agriculture.*

The elevated plateau of Mysore is eminently suited for sugarcane breeding work on account of its altitude, distribution of rainfall in the two monsoons and the general climatic conditions. Most of the exotic canes flower annually in succession beginning from October and ending in January. They ripen and shed their seeds in January when the weather is cool and often foggy. Such a condition is very well suited for the germination of sugarcane seeds, and we have noticed cane seeds germinating in profusion in the cane field. Many canes which do not flower elsewhere seem to flower here. These facts were observed by the Indian Sugar Committee in 1919 and they went so far as to suggest the opening of a Breeding Station in Chittoor District since Bangalore was situated in the Indian State of Mysore. Our experience during the last 18 years is that the Hebbal Farm is admirably situated for carrying on sugarcane breeding work.

Work on sugarcane breeding was started in Mysore early in 1912. We have been co-operating with Dr. C. A. Barber, Professor J. B. Knight and Rao Bahadur T. S. Venkataraman since then. Very early, in our work, we discovered that the exotic canes and even the standard indigenous canes were hybrids in their constitution and that they produced, in their turn, an innumerable number of variations. It was, therefore, in order to increase the number of chances of securing good ones, that several lakhs of seedlings were raised every year from different parentage. The seedlings originally selected for their great vigour and other agricultural qualities were carefully tested for the quality of their juice and only those showing a high sucrose content were retained. Some parents like Red Mauritius were found to produce vigorous seedlings and others like Barbados 208 to produce rich seedlings but very poor in vigour. It was only by a thorough chemical control in the work from the very beginning that we have been able to isolate vigorous canes rich in sucrose and having a low quantity of glucose. Our main object all along has been to produce canes for high tonnage and for producing good hard jaggery with keeping qualities.

At present, we have in the specimen plots 28 indigenous and 42 exotic sugarcane varieties under observation. Some of them produce more rich seedlings than others. The following figures give a few examples of the character of some parents.

	% of seedlings having total Solids in their Juice.	
	More than 15%.	Less than 15%.
Barbados .. .. .	27.3	72.7
Striped Mauritius .. .. .	17.5	82.5
White Mauritius .. .. .	30.0	70.0
Ashy Mauritius .. .. .	18.6	81.4
Java Mysore .. .. .	9.5	90.5
Cheni .. .. .	70.0	30.0

Red Mauritius, Java canes in general, Demarara canes and many others have given vigorous seedlings ; but a very small number of them have produced seedlings rich in sugar. On the other hand, there have been among the seedlings of all Barbados canes, many rich canes but they all lack in vigour. In a few years, we were able to discard many canes as bad parents in breeding work. It is generally considered that thick rich canes or Noble canes have not much vigour and therefore attempts are being made to cross them with wild saccharums like *S. spontaneum* to introduce vigour into the Noble canes. Our experience has been that all the noble canes are hybrids and they, on selfing, produce seedlings of various kinds among which, many are thin or reed canes of which some are rich in sugar and others poor. Often, these thin canes are hard and useless but on rare occasions, we have secured vigorous rich canes. We are inclined to believe that in many cases some inhibiting factors have been suppressing vigour and other characters in noble canes. One of them, Local Striped 0-0-3-8, a seedling raised from local Pattapatti, is very vigorous and fairly rich in sugar. A small plot on the Hebbal Farm recently harvested gave a yield of over 65 tons when the canes were only seven months old. Such thin, rich and vigorous seedlings have been now raised out of H. M. 89, Red Mauritius and Striped Mauritius. Heterozygous thick canes have been crossed with the thin wild forms of saccharums to get vigorous seedlings. When it has been observed that the thick character is recessive in most of the canes, it is rather doubtful to say whether the thin seedlings raised from the crossed arrows are the results of the crosses made or only the segregates rising out of the heterogeneous parent. This problem becomes more complex when a number of hybrids are used for crossing one with another in succeeding generations. The pollen and the ovaries are so heterozygous that it is difficult to make out in what manner the combinations have taken place in the resulting hybrids. In these complex crosses, there is every chance of the vigour of the wild forms not being included at all. This rather crude kind of breeding work was considered sufficient as long as one believed in the blending of characters, but now that the purity of gametes has been recognised, work in future has to be based on a more scientific basis. We have, therefore, utilised all the sugarcanes as parents and made our selections out of several lakhs of seedlings. From among the seedlings raised by selfing flowers, we are trying to raise homozygous canes. There is every likelihood of these seedlings being less complex than their parents. We have further noticed that while thick canes have produced thick and thin seedlings, thin canes have so far not produced any thick canes. By selfing a few generations of selected seedlings, we hope to establish pure homozygous canes rich in sugar both in the thick and thin canes. From such a foundation stock, we propose to build up new seedling varieties. As this kind of work requires a good deal of technical help, for want of facilities and staff it has been kept in abeyance. Meanwhile, the heterozygous sugarcanes have been utilised for breeding purposes. It will be many years before the hybrid nature of standard canes is fully exploited.

In 1914, two thousand selected seedlings were planted out, of which 300 were promising. Twenty of them contained more than 20 per cent. sucrose, one of them giving as much as 22 per cent. sucrose in the juice. By 1917, as many as 58 promising ones were under observation. It was in this year that H. M. 320 and H. M. 544 were evolved. Even in the early stages, some of them indicated their capacity for very high yields. Promising ones were tested in different places as early as in 1917. In 1918, a thorough weeding of doubtful performers was made for making place for fresh seedlings. By 1923, promising seedlings had been tested in several localities in the State, in places having nearly 300 inches of rainfall and in the dry and saline tracts. H. M. 544 became popular in the eastern part of the State where the soils are sandy and had an early season. In rainy zones and on

heavy soils, these canes take a longer time to mature than the usual period of one year. It was found early that no one cane suited all the parts of the State and that a number of them were required for different places having different sets of conditions for making a successful growth. From 1923 to 1929, more attention was paid for testing canes in the districts and distributing the best ones fit for each locality. By 1930, the following canes had become established in Mysore.

1. H. M. 544 has become popular in the eastern districts and in parts of Malnad. This is quite unsuited for poor soils or gravelly soils. This will not ripen on heavy soils early. It is a very thick yellow cane.

2. H. M. 320 is a medium cane and is as rich and early as the local Pattapatti. It tillers freely and produces the greatest quantity of good hard jaggery. Yields of 60 tons have been harvested. It is now displacing all other canes in most of the eastern districts of Mysore.

3. H. M. 553 is becoming popular in the Malnad and semi-Malnad and in Chitaldrug District.

4. H. M. 602 is a thin cane and is well suited for alkaline soils in the dry parts of the State.

5. Babbur striped, a bud-variation from H. M. 544, is very vigorous and is replacing H. M. 544 in many places; but it is slightly poorer in sugar than H. M. 544 and takes slightly longer to ripen.

Many promising seedling canes are under observation on the Hebbal Farm for several years. The quality of juice and the average yield of some of the promising seedling canes are as follows :—

	Quality of juice.		Average.	
	%Glucose.	%Sucrose.	Yields.	%Yield.
Local Pattapatti ..	20.35	.34	19.3 tons.	100.0
H. M. 320 ..	20.00	.22	40.3 "	203.4
H. M. 544 ..	18.75	.45	29.0 "	151.8
H. M. 500 ..	20.75	.28	29.1 "	152.6
H. M. 312 ..	19.80	.15	34.3 "	177.7
Babbur Striped ..	19.25	.33	27.8 "	144.3

The present season is very interesting on the Hebbal Farm. In seven months after planting all the Java seedlings including E. K. 28 and P. O. J. 2878 and almost all the Coimbatore seedlings have begun to flower. The canes are quite short and there is no possibility of their producing heavy yields. On the other hand, our more recent seedlings H. M. 603 and H. M. 604, H. M. 605 and H. M. 606 have made enormous growth and are still growing. The North Indian canes have as usual made a trudy growth. Coimbatore seedlings are giants by their side and they, in their turn, look like dwarfs by the side of our rich thin canes. It is quite possible that some of our thin canes are also suited to other parts of India. Dr. Posthumus of Java who visited the Hebbal Farm this year lately was disappointed to see the performance of P. O. J. 2878. He has an inclination to try our canes in Java on the plateau regions, if possible.

It was indicated by the "Indian Sugar Committee" in their report that new canes should be evolved to make the best use of good cultivation and manuring.

We have not lost sight of that suggestion in our work. Manurial experiments on the Hebbal Farm have clearly shown that to get heavy yields, the seedlings require adequate manuring. The following table gives the results of trials in 1921.

					Cake alone.	Cake and Am <sub>2</sub> SO <sub>4</sub> .
H. M. 14	..	..	..	..	26.8 tons.	32.7
H. M. 544	..	..	..	..	38.2 „	47.5
H. M. 312	..	..	..	..	40.8 „	54.7
H. M. 310	..	..	..	..	23.2 „	33.6

It was believed that the jaggery from seedling canes would not be quite as good as that from our rich Pattapatti cane. Experiments conducted on the estates of Mr. Ooragahalli Krishna Iyengar in 1920 showed the following facts. The canes were grown and the jaggery was made by Mr. Ooragahalli Krishna Iyengar.

*Analysis of Jaggery.*

Cane.			Total Solids.	Sucrose.	Glucose.
Local Pattapatti	..	..	89.39	72.5	11.37
H. M. 544	..	..	89.35	72.0	11.37
H. M. 310	..	..	88.90	76.0	6.75
H. M. 14	..	..	90.35	71.0	10.87

At present jaggery made from H. M. 320 and H. M. 500 is quite as good as any jaggery made in the State. H. M. 602 is producing high class jaggery in the alkaline tracts. We are now trying to produce canes for much higher yields and also rich, vigorous early maturing canes. Our future success lies in giving the raiyat the right sort of cane for his land in his locality and enable him to reap the maximum profit out of his labours.

The future\*problem is not entirely one of producing a thick cane or a thin cane but one of producing canes which would increase the profits of the raiyat. Thin canes usually tiller freely. If the canes are thick, their number per acre will decrease. If the canes are tall or heavy, then also the number falls down. We should try to get canes which would ripen early enough not to upset the rotations which suit a locality and at the same time, attempt to produce heavy tonnage. We desire to extend the work on sugarcane but cannot do so without outside help.

The whole work on sugarcane breeding has been carried on by the staff in the Department whose major work is breeding work on ragi. There is no staff at present specially set apart for sugarcane work. Scientific knowledge during these 18 years has greatly advanced and we have gained in the field and in the laboratory much experience. A definite programme of work for sugarcane breeding has been already drawn up by the department. As facilities and funds become available, different problems will be taken up in the order of their merit.

1. We shall try to lay out bigger plots of standard varieties to get larger quantities of fertile seeds.

2. Attempts will be made to inbreed by selfing a number of promising varieties to secure a foundation stock of homozygous varieties.

3. Cytological investigations which have been already taken on hand will be continued ; for the present knowledge is quite obscure and the results so far obtained by various investigators are quite conflicting.

4. Improvement of sugarcanes by selections among bud variations will be vigorously pursued. We had some interesting results in this line of work. The local *Rashtali* has given a green and yellow striped cane. *Pundia* of Poona has also produced a similar cane and it was sent over to us from Poona by Professor J. B. Knight. H. M. 89 and H. M. 165 have given red and yellow striped canes. Red Mauritius has produced a black and red striped cane. P. O. J. 33a has produced a red and yellow striped cane which in turn has given vigorous white canes like H. M. 602. H. M. 544 has produced the vigorous babbur striped cane. Similarly, striped canes have been secured from H. M. 320 and other seedlings which are now under observation. It is a very rare instance to get a striped cane among the seedlings even from among seedlings raised from striped canes. Probably, on account of the dominance of the colours one over the other, simple colours only are exhibited in the hybrids. Whereas, in the bud variations, two colours may segregate to form bands. However, this phenomenon not only gives an indication as to the origin of banded canes but also indicates that in various other characters also, there may be a good deal of variations which might be utilised in breeding work.

Recently, X-Ray has become a powerful factor in plant breeding to induce variations by bringing about changes in the constitution of Gametes or Zygotes. Much work has been done on cereals in Europe and America. In Java, they are using X-Rays to bring about variations in Tobacco. In his recent visit to Java, Dr. Coleman saw some interesting results already obtained in their work. In America, they are using X-Ray for bringing about bud variations in fruit trees. As many of the canes do not flower at all or the periodicity of flowering does not coincide and the chances of getting the required kind of variations in seedlings are a matter of conjecture, using X-Ray to produce bud variations at will, is going to be a powerful factor in the hands of the plant breeder. Since Hebbal Farm has been fully equipped with electric energy, it will be an ideal place to start this kind of work. So far as my information goes, X-Ray has not been used by any breeder in sugarcane breeding and it has not been used in any class of breeding work in India.

Mysore plateau is ideally situated for sugarcane breeding work and producing any class of cane. There are already many thick canes and a few thin canes which are worthy of trial in other parts of India. Information gathered by the Sugar Committee goes to show that there are several hundred thousand acres fit for thick canes in Upper India distributed in various provinces from Peshawar to Assam. By strengthening the present staff and supplementing the present equipment with an X-Ray apparatus which could be used in the fields, an impetus will be given to sugarcane breeding work in Mysore. And we can help the cane cultivator in Mysore in particular, and India in general, to reap bigger harvests and help to stabilize the Sugar Industry.

## ENCLOSURE II.

EXTRACT FROM THE PROCEEDINGS OF THE 4TH MEETING OF THE SUGAR COMMITTEE HELD AT NEW DELHI ON TUESDAY, THE 8TH DECEMBER 1931.

5. Application from the Government of His Highness the Maharaja of Mysore for a grant of Rs. 21,000 spread over a period of five years for the breeding of thick canes (Enclosure I).

Rao Bahadur Venkataraman was asked to start the discussion. He said that the Indian Sugar Committee of 1920 had considered Bangalore, Coimbatore and Chittoor for a Sugarcane Breeding Station as cane was fertile in these places. Bangalore had to be given up for various reasons and those reasons still existed. He added that in breeding, the same basic principles applied to thick canes as in the case of thin canes and it was also possible or likely that thin canes or medium canes might take the place of thick canes in Southern India where the latter were grown. For example, at Anakapalle Co213, a medium cane, gave better return than the local thick cane. As regards X-Ray treatment, he said it was only an experiment. It had been carried out at Trinidad but the results were uncertain. It was therefore not a line which was sure to give results. He also referred to page 207 of the Indian Sugar Committee's report and said that that Committee was of opinion that the value of the crop to the State did not justify the money and attention which were already being paid to that crop in that State. He said that if the scheme was to be sanctioned, it should be an all-India scheme. Mr. Mehta said that it would be a useful thing if somebody else besides Rao Bahadur Venkataraman also undertook breeding work. He said this would produce more trained men. Mr. Walchand Hirachand said that the co-operation of Mysore State would be very welcome. The grant wanted was a small one. Chowdhry Mukhtar Singh said that the new canes bred in Mysore should be available to others outside Mysore for he was afraid there might be some difficulty on that score. Mr. Burt said that the Imperial Council of Agricultural Research would see that this was arranged for. He added it was only a question of co-operation between Coimbatore and Mysore. The scheme was in the end agreed to.

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## APPENDIX XIII

SUBJECT No. 14.

## SCHEME FOR THE ESTABLISHMENT OF A SUGARCANE RESEARCH STATION IN THE PUNJAB.

At their meeting held at New Delhi on the 7th December 1931 the Sugar Committee of the Imperial Council considered an application from the Government of the Punjab (Enclosure I), for a grant for the establishment of a Sugarcane Research Station. The scheme was referred to a Sub-Committee for detailed examination and the report (Enclosure II) of the Sub-Committee was adopted by the main Committee.

2. Statements Nos. 1 and 2 appended to the main scheme have been revised in the light of the recommendations of the Sugar Committee and it will be seen from (Enclosure III) that the scheme now involves a total expenditure of Rs. 1,72,970 (Rs. 9,650 non-recurring and Rs. 1,63,320 recurring) spread over a period of 5 years as against Rs. 2,54,570 (Rs. 16,450 non-recurring and Rs. 2,38,120 recurring) provided for in the original scheme. The Government of the Punjab have offered to contribute an annual grant of Rs. 8,000 towards the scheme. The net amount required from the Council on account of this scheme is therefore Rs. 1,32,970.

The scheme is now submitted for the consideration of the Advisory Board.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

NEW DELHI,

The 2nd January 1932.

## ENCLOSURE I.

## SCHEME FOR THE ESTABLISHMENT OF A SUGARCANE RESEARCH STATION IN THE PUNJAB.

As a sugarcane-growing Province the Punjab ranks second in importance in India. Upwards of half a million acres of sugarcane, representing over 15 per cent. of the total cane crop of India are grown annually. Owing to the prevailing low prices of wheat and cotton little money is to be made at present out of these crops by the cultivator, and it becomes more than ever necessary to stimulate the growing of higher yielding varieties of sugarcane which is now one of the cultivator's principal money-making crops.

Again, with the erection of sugar factories in the Province the manufacture of white sugar has now become a matter of practical interest to the Punjabi. This step forward increases the necessity of paying more attention to the sugarcane crop with a view to replacing by higher yielding varieties of cane the local varieties still grown on a large scale, to the introduction in particular tracts of those new varieties most suitable for them and to the control of insect pests and fungal diseases to which this crop is subject.

The climate of the Punjab is not suitable for cane-breeding work, and it is necessary to continue to introduce and to test new seedling canes from Coimbatore or elsewhere. During the past few years certain Coimbatore varieties have been introduced into the Province. As a result of their high yielding capacities an area of about 80,000 acres was grown under these improved varieties during the past year. For the benefit of the cultivator it is essential not only to press



on with the replacement by these varieties of the indigenous canes, which still form the bulk of the sugarcane crop, but to redouble our efforts to make available to him, after thorough trial, further new varieties still better than those hitherto introduced. This work is being done gradually on several of our Departmental Experimental Stations. But on all these farms the work has to take its place in competition with, and alongside, investigations on all the other crops of the locality. To get the best results and to obtain them most quickly it is desirable to have a separate sugarcane research scheme, under which investigations can be intensified and many more varieties can be tried.

The sugarcane growing tracts in the Punjab may be divided into four broad areas :—

- (i) The sub-montane tract including the districts of Gurdaspur, Hoshiarpur and Sialkot.
- (ii) The tract of the South-Eastern Punjab, which includes the districts of Rohtak and Karnal.
- (iii) The Central districts including Ludhiana, Jullundur, Amritsar, Lahore and Gujranwala.
- (iv) The new Canal Colonies, in which Lyallpur and Sheikhpura are important sugarcane-growing districts.

The attached table shows the area of cane grown in 1929 in each of the principal cane-growing districts of the Province. These areas have all been considered carefully, with a view to selecting the best possible site for the present scheme. Ultimately the choice centred round Gurdaspur, Karnal, Jullundur and Lyallpur. Hitherto Gurdaspur has been the main Departmental sugarcane-growing farm. Experience, however, over a number of years has proved that it is not an ideal station for sugarcane work, in that the locality is subject to frosts which at times cause severe damage to the cane crop. The Coimbatore varieties of sugarcane which have been introduced there are very late in ripening. Probably the period of growth is unduly prolonged by autumn rains. It is, therefore, felt that the present scheme should be carried out elsewhere.

At Karnal the area of land at the disposal of the Department is small and the water supply poor, so much so that at most not more than 3 or 4 acres of irrigated sugarcane can be grown annually on the existing farm. Further, it is understood that the Government of India intend to develop sugarcane work at their own farm at Karnal.

Jullundur suffers from two disadvantages, in that the area of land possessed by the Agricultural Department is small and the water supply from wells is very inadequate.

When Government considered the scheme for a Sugarcane Research Station some time ago, the Department was informed that the scheme must be made to fit one or more of the existing Departmental Farms. In view of the considerations given above in connection with Gurdaspur, Karnal and Jullundur, this decision brings the choice down ultimately to Lyallpur.

As a sugarcane-growing District, Lyallpur grows from 30 to 50 thousand acres of cane annually. This area represents about 10 per cent. of the sugarcane crop in the Punjab, and as a District, Lyallpur ranks third in importance from the sugarcane-growing aspect. The Agricultural Department has at Risalewala, just outside Lyallpur, a farm of some 1,100 acres, of which 220 acres are devoted to the Cotton Research Scheme financed by the Indian Central Cotton Committee.

A further 300 acres have been earmarked for the Research Scheme on Water Requirements of Crops now before the Imperial Council of Agricultural Research. It is proposed now to utilize another 100 acres of this farm for the Sugarcane Research Scheme.

The present layout of the Risalewala Farm provides for a four years' rotation whereby crops can be grown in blocks. This layout is suitable for the present scheme and no additional expenditure would be incurred in this connection. There would thus be 25 acres under sugarcane experiments annually. The land is canal,—irrigated, but to permit of growing sugarcane to the above intensity, an additional supply of canal water for these 100 acres will be required, the addition being probably of the nature of 50 per cent. more than the present supply.

Whilst it is proposed that the main research work under this scheme should be carried out at the Risalewala Farm, it is intended that the present facilities to whatever extent available on other farms at Gurdaspur, Jullundur and Karnal will be utilised for work subsidiary to that done at Lyallpur; this subsidiary work being carried on in the ordinary course of experiments with the sugarcane crop on these farms and being financed from the ordinary farm budgets.

The work which it is proposed to carry out under this scheme includes the following :—

- (1) The growing and testing of new seedling canes obtained from Coimbatore or elsewhere.
- (2) Investigations into cultural methods, the economics of artificial fertilizers and the water requirements of the crop.
- (3) Chemical analysis of the various varieties grown, together with the study of varying sucrose content with age, etc., with a view to possible variation of maturing time so as to make possible the liability of the crop at maximum sucrose content through an extended crushing season.
- (4) Investigations into methods of prevention and the control of entomological and mycological diseases of the sugarcane crop.
- (5) Investigations from an economic standpoint of the present sugar market as to local eating consumption, refiner's requirements, and possible export markets to ascertain if possible whether *gur*, (crude sugar) as used by the home refiner, or concentrated syrup can most profitably be the primary product to be made by the sugarcane producer.
- (6) Based on the results of No. (5), investigations leading to improved *gur* production by the introduction of better furnaces, evaporative equipment, and production methods.
- (7) Investigations leading to the design of suitable equipment and methods for the production of crude crystalized sugar either in the village, or in suitable centres, as a possibly more profitable primary product not only from the standpoint of consumption within the Province, but also as a possible export product.

The expenditure proposed under this scheme has been reduced in every direction where reduction was possible by making full use of such facilities as exist or can be made available. Thus, it is not proposed to erect any buildings, but to utilize after repair such *katcha* quarters and buildings as are available at the

Risalewala Farm, together with certain of the stores and other *pucca* buildings already provided there. Again where elsewhere a field laboratory would have been necessary for the chemical, botanical, entomological and mycological aspects of the scheme, all these problems will be dealt with in the laboratories of the Research Institute and Agricultural College, Lyallpur, with the assistance, when needed, of the University Technical Chemistry Laboratories, Lahore.

In view of the importance of the scheme to the province it is proposed to place the Research Station and the work outlined above in this scheme under the charge of a Sugarcane Specialist Officer, who would carry out the work under the Director and would be in a position to hand over special branches of the investigation to the control of the various Specialist Officers at present available. Thus he would have the collaboration of the Professor of Agriculture, the Agricultural Chemist to Government, the Associate Professor of Botany, the Entomologist to Government, the Mycologist being appointed at present, and other specialist officers. In addition, with reference to the manufacturing side of the investigation, the collaboration of the University Professor of Technical Chemistry, and the University Technical Chemistry Laboratories at Lahore, are available for help in this undertaking.

It is further to be pointed out that the Mycological Assistant shown in Statement I will be suitable only if the services of the qualified Mycologist who it is understood is to be appointed by the Punjab Government are available for control of this work. Should such an officer not be appointed, the services of a more highly qualified Mycologist than the Assistant described in Statement I will be required for this investigation.

The Supplementary work which will be carried out on the other farms previously referred to, will be devoted mainly to testing the applicability locally of results obtained at the Central Research Station at Risalewala. These investigations will be carried out by the Deputy Directors of Agriculture concerned, such of their staff, equipment, land and other facilities as are required, being made available.

According to the estimate attached the non-recurring expenditure on the scheme amounts to Rs. 16,450, and the recurring expenditure over a period of five years comes to Rs. 2,38,120 totalling Rs. 2,55,000 in round figures. It is proposed that the Imperial Council of Agricultural Research be requested to provide funds to the above extent over a period of five years. The Punjab Government on its part would make available the following :—

- (a) 100 acres of land valued Rs. 70,000.
- (b) The part-time services of the Professor of Agriculture ; the Agricultural Chemist ; the Associate Professor of Botany ; the Entomologist, etc.
- (c) Buildings—some existing and some after repairs.
- (d) Laboratories and laboratory equipment, at the Research Institute, Lyallpur.
- (e) Staff ; land ; equipment, etc., for supplementary experiments at the Gurdaspur, Jullundur and Karnal Farms.

This scheme is not intended to diminish in any way the experimental work on sugarcane which is being carried out at present by the Punjab Agricultural Department. Its aim is to increase and expand those investigations with a view

to the total replacement at an early date of the local indigenous canes at present grown in the Province, by the newest and highest yielding varieties of Coimbatore canes. By effecting improvements in the methods of manufacture and quality of Punjab *gur* it is hoped to create a demand for it on the part of local white sugar factories. Much has been done in the Punjab for the improvement of the wheat and cotton crops. The sugarcane crop of the Province, however, is still capable of very great improvement. In comparison with wheat and cotton the market rate for *gur* is still high. It is thus more than ever essential that everything possible should be done to help the cultivator to tide over the present difficult times by improving the crop which still leaves him a fair margin of profit.

## STATEMENT No. 1.

Showing details of staff required for the Sugarcane Research Station at Risalewala.

Post.	Monthly rates of pay.				
	1st year.	2nd year.	3rd year.	4th year.	5th year.
	Rs.	Rs.	Rs.	Rs.	Rs.
1. Sugarcane Specialist with special knowledge of Botany Rs. 500—50—700.	500	550	600	650	700
2. Farm Manager, Rs. 130—10—170 ..	130	140	150	160	170
3. 1 Agricultural Assistant, Rs. 100—10—140.	100	110	120	130	140
4. 4 Mukaddams, Rs. 25—1—29 ..	100	104	108	112	116
5. 1 Store-keeper on Rs. 50 .. ..	50	50	50	50	50
6. 1 Chaukidar on Rs. 14 .. ..	14	14	14	14	14
7. 2 Sweepers on Rs. 13 .. ..	{ 13 13	{ 13 13	{ 13 13	{ 13 13	{ 13 13
8. 1 Technical Chemist, Rs. 250—20—330	250	270	290	310	330
9. 2 Chemical Assistants, Rs. 120—10—160	240	260	280	300	320
10. 1 Entomological Assistant, Rs. 120—10—160.	120	130	140	150	160
11. 1 Mycological Assistant, Rs. 120—10—160.	120	130	140	150	160
12. 2 Laboratory Attendants, Rs. 20—1—24	40	42	44	46	48
Total Monthly Expenditure ..	1,690	1,826	1,962	2,098	2,234
Total Yearly Expenditure ..	20,280	21,912	23,544	25,176	26,808
Add pay of one Engine driver for three months	180	180	180	180	180
Total ..	20,460	22,092	23,724	25,356	26,988
GRAND TOTAL ..	1,18,620				

## STATEMENT No. 2.

Showing details of miscellaneous expenditure required for the Sugarcane Research Station at Risalewala.

	Non-recurring.	Recurring.
	Rs.	Rs.
<i>Buildings</i> .. .. .	4,000	..
<i>Labour—</i>		
16 Beldars at Rs. 18.. .. .	..	3,500 (round).
Variable labour .. .. .	..	2,000
<i>Purchase and maintenance of bullocks—</i>		
16 Bullocks at Rs. 200 .. .. .	3,200	..
Maintenance at Rs. 20 per pair per month <i>plus</i> 280 for replacements.	..	2,200
Machinery and Implements (Agricultural) ..	8,800	1,200
Machinery and equipment to be developed or purchased (manufacturing).	..	10,000
Manure .. .. .	..	1,000
Travelling Allowance .. .. .	..	2,000
Water Rates.. .. .	..	1,000
Apparatus and Chemicals .. .. .	200	500
Contingencies and other charges .. .. .	250	500
<b>Total</b> ..	<b>16,450</b>	<b>23,900</b>
<b>For five years</b> ..	<b>16,450</b>	<b>1,19,500</b>
<b>Staff for five years</b> ..	<b>..</b>	<b>1,18,620</b>
<b>GRAND TOTAL</b> ..	<b>16,450</b>	<b>2,38,120</b>

NOTE.—There will be an estimated income from sales of crops, etc., amounting to some Rs. 12,000 per year. It is suggested that this might be applied towards the expense of the scheme.

Table showing the area of cane grown in 1929 in each of the principal cane growing districts of the province.

Serial No.	Name of district.	Irrigated.	Unirrigated,	Total.
		Acres.	Acres.	Acres.
1	Gurdaspur .. .. .	20,383	17,748	38,131
2	Sialkot .. .. .	26,325	4,662	30,987
3	Lyalpur .. .. .	30,941	5	30,946
4	Gujranwala .. .. .	24,386	706	25,092
5	Karnal .. .. .	19,955	1,903	21,856
6	Jullundur .. .. .	19,469	490	19,959
7	Amritsar .. .. .	15,995	1,473	17,468
8	Sheikhupura .. .. .	17,005	63	17,068
9	Rohtak .. .. .	15,027	246	15,273
10	Hoshiarpur .. .. .	4,460	10,149	14,609
11	Ambala .. .. .	4,669	7,791	12,460
12	Gujrat .. .. .	10,385	413	10,798

#### ENCLOSURE II.

EXTRACT FROM THE PROCEEDINGS OF THE FOURTH MEETING OF THE SUGAR COMMITTEE HELD IN DECEMBER 1931.

4. *Scheme for the establishment of a sugarcane research station in the Punjab.*

Mr. Burt read the report of the Sub-Committee appointed yesterday to consider the various provincial schemes. The report was adopted.

*Report.*

The Sub-Committee is not satisfied that Lyallpur is the best centre for a sugarcane research station in the Punjab. At previous meetings of the Sugar Committee the importance of the central tract has been emphasised and they would like the question of establishing the sugarcane research station on the departmental farm at Jullundur to be re-examined.

Subject to the re-examination of the site, the scheme is recommended for sanction with the following modifications :—

(1) *Pay of Sugarcane Specialist*.—It is considered that the scale of Rs. 250—25—500 with liberty to pay an initial salary up to Rs. 400 per mensem is adequate.

(2) The post of Technical Chemist is unnecessary for the programme put forward and should be omitted : also one post of Chemical Assistant.

This will reduce the expenditure on Staff to about Rs. 83,220 spread over five years.

As regards expenditure on Statement No. 2, no special grounds have yet been shown for a departure from the Council's principle that buildings should be provided by the Local Government. Provision for machinery and implements is excessive. A sum of Rs. 6,000 would be adequate if the Station is established at Jullundur where water-lifting machinery would be needed : otherwise about Rs. 2,000. The recurring grant for machinery and equipment on the manufacturing portion of the scheme should be reduced to Rs. 2,000 per annum for reasons subsequently stated. This reduces the total cost of the scheme to approximately Rs. 1,73,170 or Rs. 1,33,170 net after deducting the 40,000 offered by the Punjab Government.

## II.—TECHNOLOGICAL.

### *Punjab.*

It is recommended that sections 6 and 7 of the proposed programme of work be omitted pending further experience by the Sugar Technologist of the problems now under examination has been gained. It is recommended that a grant of Rs. 10,000 spread over the 5 years be provided for the purchase and testing of equipment to enable the Agricultural Department, Punjab, Lyallpur, to cooperate with the Sugar Technologist and to take advantage of his results and test their applicability to local conditions in the Punjab.

In connection with this report Chowdhry Mukhtar Singh enquired if there was any co-ordination between the research schemes of the various provinces to which Mr. Burt replied that these schemes were the result of our previous decision to have a chain of research stations in the main sugarcane belt.

In connection with the Punjab scheme, Mr. Burt explained that the question of site was very important. The Sugar Committee had all along been of the opinion that the sugarcane research station should be located in the central Punjab. Rao Bahadur Venkataraman said in this connection that in Lyallpur cotton was a competitive crop with sugarcane and the area under sugarcane was fluctuating very considerably from year to year in that tract dependent upon the price of cotton. It was important therefore that our research station should be established in a tract where the area under cane was steady.

In connection with the technical side of the Punjab scheme, Mr. Burt explained and the Committee agreed that they should wait till Mr. Srivastava's work progressed a little further and it was on this account that the Sub-Committee had reduced the proposed annual grant of Rs. 10,000 for sugar machinery to Rs. 2,000 per annum.

## ENCLOSURE IIL

*Revised Statement No. 1, showing details of staff required for the Sugarcane Research Station at Risalewala.*

Post.	Monthly rates of pay.				
	1st year.	2nd year.	3rd year.	4th year.	5th year.
	Rs.	Rs.	Rs.	Rs.	Rs.
1. Sugarcane Specialist with special knowledge of Botany, Rs. 250—25—500. (Starting Rs. 400).	400	425	450	475	500
2. Farm Manager, Rs. 130—10—170	130	140	150	160	170
3. 1 Agricultural Assistant, Rs. 100—10—140.	100	110	120	130	140
4. 4 Mukaddams, Rs. 25—1—29 ..	100	104	108	112	116
5. 1 Store-keeper on Rs. 50 ..	50	50	50	50	50
6. 1 Chaukidar on Rs. 14 .. ..	14	14	14	14	14
7. 2 Sweepers on Rs. 13 .. ..	{ 13	13	13	13	13
	{ 13	13	13	13	13
8. 1 Chemical Assistant, Rs. 120—10—160.	120	130	140	150	160
9. 1 Entomological Assistant, Rs. 120—10—160.	120	130	140	150	160
10. 1 Mycological Assistant, Rs. 120—10—160.	120	130	140	150	160
11. 2 Laboratory Attendants, Rs. 20—1—24.	40	42	44	46	48
Total Monthly Expenditure ..	1,220	1,301	1,382	1,463	1,544
Total Yearly Expenditure ..	14,640	15,612	16,584	17,556	18,528
Add pay of one Engine driver for three months.	180	180	180	180	180
Total ..	14,820	15,792	16,764	17,736	18,708
GRAND TOTAL ..			83,820		



*Revised Statement No. 2, showing details of miscellaneous expenditure required for the Sugarcane Research Station at Risalewala.*

	Non-recurring.	Recurring.
	Ra.	Ra.
<i>Buildings, Labour—</i>	.. .. .	..
16 Beldars at Ra. 18 .. .. .	..	3,500
Variable labour .. .. .	..	(round). 2,000
<i>Purchase and maintenance of bullocks—</i>		
16 Bullocks at Ra. 200 .. .. .	3,200	..
Maintenance at Ra. 20 per pair per month plus Ra. 230 for replacements.	..	2,200
Machinery and Implements (Agricultural) .. .. .	..	1,200
Machinery and equipment to be developed or purchased (manufacturing).	6,000	2,000
Manure .. .. .	..	1,000
Travelling Allowance .. .. .	..	2,000
Water Rates .. .. .	..	1,000
Apparatus and Chemicals .. .. .	200	500
Contingencies and other charges .. .. .	250	500
Total ..	9,650	15,900
For five years ..	9,650	79,500
Staff for 5 years ..	..	83,820
Total ..	9,650	1,63,320
GRAND TOTAL ..	1,72,970	

## APPENDIX XIV.

SUBJECT No. 15.

APPLICATION FROM THE UNITED PROVINCES GOVERNMENT FOR  
A GRANT FOR INVESTIGATION INTO THE PROBLEM OF SUGAR  
INDUSTRY IN THE UNITED PROVINCES.

Attention is invited to the attached application (Enclosure I) from the Government of the United Provinces for a grant of Rs. 1,76,810 for investigation into the problem of sugar industry in the United Provinces. At their meeting held on the 7th December 1931, the Sugar Committee appointed a Sub-Committee consisting of Messrs. B. C. Burt, R. C. Srivastava, N. C. Mehta, Khan Bahadur Fateh-ud-Din and Rao Bahadur T. S. Venkataraman to examine and report, *inter alia*, on the application from the United Provinces Government. The report of the Sub-Committee (Enclosure II) was accepted by the Sugar Committee at their meeting held on the 8th December 1931.

The original scheme (Enclosure I) involved a non-recurring expenditure of Rs. 31,930 and a recurring expenditure of Rs. 1,44,880 or a total of Rs. 1,76,810 spread over a period of 5 years. The scheme as revised by the Sugar Committee involves (Enclosure III) a non-recurring expenditure of Rs. 23,000 and recurring expenditure of Rs. 94,820 or a total of Rs. 1,17,820 spread over 5 years. This amount will be reduced further if the United Provinces Government purchase the machinery, provided under item II-Technical (Enclosure III) at the end of the first year, as recommended by the Sugar Committee. In that case the net amount required from the Council will be only Rs. 1,05,070.

The scheme is now submitted for the consideration of the Advisory Board.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

*The 2nd January 1932.*

## ENCLOSURE I.

APPLICATION FROM THE UNITED PROVINCES GOVERNMENT FOR A GRANT OF  
Rs. 1,76,810 (Rs. 1,44,880 RECURRING AND Rs. 31,930 NON-RECURRING) FOR  
INVESTIGATION INTO THE PROBLEM OF IMPROVEMENT OF SUGAR INDUSTRY IN  
THE UNITED PROVINCES.

*(The scheme has been prepared with the approval of the Provincial Agricultural  
Research Committee.)*

INDIA occupies one of the foremost positions in the cane-growing countries of the world and over 50 per cent. of the Indian crop is found in the United Provinces. The general facts of distribution, and the present condition of the industry, all point to the United Provinces, as being the centre of the subject, as far as the improvement of sugar production in India is concerned. The area under cane is already considerable and sugarcane is perhaps the most important money crop cultivated. The importance of the crop is on the increase since the opening of the Sarda Canal and the introduction of the improved varieties from

Coimbatore ; more so, when in these days of slump in prices, sugarcane is one of the very few crops which is paying to the cultivator. A most striking fact brought out by studying the statistics of the sugar industry is the extraordinary low production of sugar in India per acre compared with that of the other main cane growing countries. The world's cane sugar output is about 14 million tons, India's production in proportion to its area should have been 7 million tons, but it is only 3.5 million tons, inclusive of this province's share of 1.75 million tons or an eighth of the total cane sugar production of the world. The general line of advance, from an agricultural point of view, appears to lie in increasing the production of cane and of juice per unit area, at the same time reducing the cost of each ton of cane grown. This can be achieved by substituting more rapidly growing and early maturing varieties for those now grown and by introducing more intensive methods of cultivation. Such varieties are being evolved at Coimbatore, which is the chief centre of sugarcane breeding, but it is necessary that the first generation trials and subsequent acclimatization and propagation for distribution must be done in the United Provinces itself. According to Howard (Crop Production, page 129) "No effective preliminary selection of the seedlings for Northern India is however possible in South India, so that a mass of material of necessity, mainly unsuited, has to be sent to the plains for trial". The Sugar Committee of 1920 in its report, page 301, also says "the opportunities of deciding at Coimbatore what seedlings are and what seedlings are not likely to prove successful in Northern India are strictly limited, and any attempt to exceed those limits may involve the rejection of seedlings, which would on local trial have proved suitable for introduction. The behaviour of cane on the soil of the cane breeding station is not an index of its behaviour elsewhere, nor is it always possible, even granted the most intimate and scientific knowledge of the local conditions of another tract, to infer from the results at Coimbatore the prospect of a particular cane proving successful in that tract".

Some acclimatization and distribution work of Coimbatore varieties has already been done at the existing Sugarcane Research Station at Shahjahanpur, but it is intended now to develop it into a first generation sub-station, where extensive trials will be carried out, and to carry out the seedlings trial at other circle farms under Deputy Directors. Besides there are many important problems—agricultural, technical and economic—the solution of which would be of considerable benefit to the field and the factory, which still remain to be tackled, will also be investigated in these provinces. A few of the important problems are as follows :—

#### I.—AGRICULTURAL

(a) *Establishment of first generation sub-station.*—For extensive trials of Coimbatore seedlings at Shahjahanpur and other circle farms under the Deputy Directors such as Partabgarh, Cawnpore, Benares, Gorakhpur, Aligarh, etc.

(b) *Comparative trials of Coimbatore and local canes, and their manurial and water requirements.*—A well-thought out plan of experiments will be laid out on the lines of field experimental technique recently elaborated at Rothemsted, with a view to obtain results capable of correct statistical interpretation, and to find out the best and cheapest combination of organic and artificial manures, and the least quantity of water required by the crop. A thorough study of different times of sowing of various varieties which seem to vary in different parts of the United Provinces will also be made.

(c) *Physiological and chemical*—*Experimental investigation of some of the external and internal factors controlling the growth and final yield of sugarcane.*—The work under this head will be altogether different from that of a purely academic nature for physiological study of the sugarcane, and will not conflict with any of the scheme, which the Imperial Council might have already sanctioned. It may conveniently be divided into two sections :—

- (1) Researches into the relation of atmospheric and soil humidity to growth, stomatal opening and transpiration, rate of growth will be determined weekly by rate of increase in dry weight. This aspect of subject is very interesting, because a clear knowledge of the relation of moisture to growth will be very helpful in solving the important problem of optimum water requirements of sugarcane.
- (2) A detailed study of the variations in the composition of sugarcane juice from July to March under different manurial conditions will throw light on the effect of different chemicals on the ripening processes of sugarcane. Chemical constituents of the soil may be responsible for delayed ripening of sugarcane in some districts of the United Provinces.

The present method of carrying on tests of juice in cane has not been standardized owing to which the results are not even comparative. According to Java standard the cane is to be crushed to such an extent as to give at least 72 per cent. juice on its weight either by single or repeated crushings, when the juice is to be polarized, under this condition the juices can be considered as comparative. Inside the cane there are bundles containing sugar-free water. These are harder than the sugar-bearing tubes. Therefore as the pressure is exerted the juice comes out first and water afterwards. Therefore when the canes are crushed the juices are rich in sugar, but when crushed more this juice becomes diluted. Therefore it is essential to fix the condition of extracting the juice on the weight of the cane before it is analysed for its juice contents. The work has never been attempted in a scientific way nor systematized properly.

*Note.*—Before sending this part of the scheme to the Imperial Council of Agricultural Research for sanction, it was thought fit to get the opinion of sugar experts. A meeting was consequently convened at the Upper India Chamber of Commerce, Cawnpore, on Thursday, October 29, at 10 A.M. and the following gentlemen were present :—

- (1) Mr. N. C. Mehta, I.C.S., Director of Agriculture, United Provinces, Chairman.
- (2) Mr. J. G. Ryan, Secretary, Upper India Chamber of Commerce, Cawnpore.
- (3) Mr. Noel Deerr, Sugar Expert to Messrs. Begg, Sutherland and Company, Cawnpore.
- (4) Mr. L. B. Gray, Director, Messrs. Begg, Sutherland and Company, Cawnpore.
- (5) Mr. R. C. Srivastava, Sugar Technologist, Imperial Council of Agricultural Research, Cawnpore.
- (6) Mr. R. L. Sethi, Economic Botanist to Government, United Provinces, Cawnpore.

(7) Mr. A. R. Khan, Head of the Sugar Section of the Harecourt Butler Technological Institute, Cawnpore.

The following resolutions were passed :—

(1) In the opinion of the Committee, it is desirable that a research sub-station should be opened in these provinces, preferably at the headquarters at Shahjahanpur, in charge of an expert officer, where experimental work should be concentrated chiefly on the cane seedlings got from Coimbatore and on the local canes of the United Provinces. The Committee, however, do not desire to exclude any experiments on plant-breeding, if the officer in charge is suitably equipped for the purpose.

(a) The Committee further recommend that the scheme should be taken up as soon as possible by the Local Government, and in case there is any difficulty for financing it, the matter may be referred for help to the Imperial Council of Agricultural Research, that it is necessary for the success of the scheme that an expert officer should be posted in charge of the sugarcane farm and the laboratories at Shahjahanpur.

The Government of the United Provinces is already spending a considerable sum annually over the Shahjahanpur Research Station, capital about two lakhs and annual revenue expenditure Rs. 17,000. This further work, for which a scheme is now forwarded, is the natural outgrowth of the work already in progress. The Local Government, being unable to spare money under the present conditions of acute financial stringency, is applying for the help of the Imperial Council of Agricultural Research in this important matter.

## II.—TECHNICAL.

*Introductory.*—The manufacture of sugar by the indigenous methods in the United Provinces is in the hands of *khandsaris* who are generally not wealthy enough to instal oil engines or electric motors and most of the crushing is done in bullock-driven mills which never give a yield of juice from the cane of over 60 per cent. and which employ all the available labour and oxen to the detriment of the preparation of fields for the ensuing sugarcane crop. Co-operative societies are developing in various villages and now that hydro-electric power is available, it would be possible to enable these societies to use electrically driven machinery for the manufacture of sugar. *Khandsaris* would also profit by the use of such machinery. The margin of profit on sugar manufacture is so small that any more efficient methods would result in a large total return owing to the enormous tonnage of cane produced in the grid area.

*Object of the grant.*—The purpose for which the present grant is required is to instal a suitable plant in the grid area for demonstrating the advantages of the use of hydro-electric energy and for helping in the introduction of similar plants run either by business firms or by Government.

*Details of the scheme.*—Mr. Srivastava, the Sugar Technologist, has prepared a specification (Annexure I) for a plant for making sugar or *gur* by the open pan process and having a capacity of 700 maunds of cane per day of ten hours. This quantity of sugarcane of the improved varieties represents the produce of one acre. The plant which will be driven by a 50-horse power motor, will therefore deal with about 50,000 maunds of cane per season and will be of the correct size for working by co-operative societies. The complete plant is estimated to cost about Rs. 17,000. The freight, erection and electric connection on charges and buildings will cost approximately another Rs. 5,000. The present

application is for a non-recurring grant from the Imperial Council of Agricultural Research of Rs. 17,000 to cover the cost of the plant. The Irrigation Branch will arrange for the trial to be carried on through the agency of a co-operative society in the grid area in the Bijnor district in collaboration with the Registrar of Co-operative Societies. All cost of erection and running of the plant will be borne by the Irrigation Branch of the United Provinces Government who would recover it from the co-operative society by making a small charge on the electrical units used. At the end of the first season the society will have the option of taking over the plant at a price to be settled with the Imperial Council of Agricultural Research, not exceeding 75 per cent. of the original cost. If the society does not choose to take the plant the Imperial Council of Agricultural Research will dispose it off as it considers best.

*Conclusion.*—The Irrigation Branch are installing near Moradabad a 15-horse power Massey plant lent by that firm and it will be possible, during the current season, to obtain some data regarding the possibilities of this method of sugar manufacture. A plant of this size is, however, much too small even for one village, and a larger plant, of at least 50 B.H.P. size, is necessary for economical working.

If the experiment is successful, the main items of future plant could be obtained on the hire-purchase system from the manufactures and the cost recovered from the charges made for units used. It is very difficult to predict whether such a scheme introduced with the closely organized sugar manufacturing industry will be a success or not, but its ultimate success by giving larger yields of sugar per acre of cane is of such importance for the economics of this province that a trial, on the modest lines indicated in this memorandum, appears to be definitely worthwhile.

### III.—ECONOMICAL.

The Board of Economic Inquiry considered the scheme of Dr. Radha Kamal Mukerji for the investigation of agricultural marketing methods and practices in the United Provinces at its first meeting on November 20, 1931, and approved the scheme. The Board is prepared to undertake a detailed inquiry on the subject with the help of the Bureau of Statistics and Economic Research.

It is proposed to make local investigations in representative districts of the province regarding the cost of production, transit charges, markets, marketing practices, finance, etc., of sugarcane in particular and other agricultural commodities in general. The information thus obtained will be collated and sifted in the office and also thoroughly discussed by a sub-committee of the Board, before formulating definite proposals for submission to the Imperial Council of Agricultural Research and the public.

The United Provinces Government have already established a Bureau of economic research since April 1931, and allotted a sum of Rs. 15,570 per annum. The Bureau is at present in the charge of the Director of Land Records who is also the Director of Statistics and incidentally happens to be the Director of Agriculture as well. A trained Economist is in charge of this Bureau with a staff of investigators. The Economic Bureau has already conducted an inquiry into the visible stocks of wheat and barley in the province and is well adapted by its experience and technical knowledge to undertake an inquiry into the cost of production of sugarcane. The Economic Bureau of the United Provinces Government is in a position to undertake the inquiry immediately which is the subject matter of item No. 4 of the agenda of the Sugar Committee of the Imperial Council of Agricultural Research. A detailed budget

is not appended for this part of the inquiry. It is already shown in appendix 2 of subject No. 4 of the agenda of the Sugar Committee. The inquiry will be conducted under the supervision of the Director of Statistics.

### EXPENSES.

#### I.—AGRICULTURAL.

The scheme on the agricultural part of the work is expected to be finished within a period of five years, but if however at the end of that period any work remains incomplete, an application for further extension of the period may be submitted. The details of expenses are as under :—

#### *Agricultural A and B (non-recurring).*

	Rs.
Apparatus for recording discharge of water ..	6,000
Total, Agricultural A and B (non-recurring) .. 6,000	

#### *Agricultural A and B (recurring).*

Staff and establishment.	First year.	Second year.	Third year.	Fourth year.	Fifth year.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
One assistant sugarcane expert (Rs. 250—25—750 per mensem), Member of Provincial Service.	3,000	3,300	3,600	3,900	4,200	18,000
Two research assistants (Rs. 110—10—150 each per mensem), one in Botany and other in Agriculture.	2,640	2,880	3,120	3,360	3,600	15,600
One assistant (Rs. 80—5—105 per mensem) (will be in charge of drawings required to be made of plant material).	960	1,020	1,080	1,140	1,200	5,400
One store-keeper (Rs. 50—3—65 per mensem).	600	636	672	708	744	3,360
Two laboratory assistants (Rs. 30—3—42 per mensem).	360	396	432	468	504	2,160
Two fieldmen (Rs. 30—3—42 per mensem each).	360	396	432	468	504	2,160
One stenographer clerk (Rs. 75—3—105 per mensem).	900	936	972	1,008	1,044	4,860
Two attendants (Rs. 12—1—16 per mensem each).	288	312	336	300	384	1,680
<i>Allowances.</i>						
Travelling allowance for officers and subordinates (during the first year more travelling will have to be done for collecting varieties).	2,000	1,500	1,500	1,500	1,500	8,000
<i>Contingencies.</i>						
Research farm contingencies ..	3,000	3,000	3,000	3,000	3,000	15,000
Manures—chemical and organic ..	2,000	2,000	2,000	2,000	2,000	10,000
Scientific literature ..	500	500	500	500	500	2,500
<b>Total, Agriculture A and B (recurring).</b>	<b>16,608</b>	<b>16,876</b>	<b>17,644</b>	<b>18,412</b>	<b>19,180</b>	<b>88,720</b>

*Agricultural C (Non-recurring).*

					Rs.
Two microscopes .. .. .	..	..	..	..	1,800
One microtome .. .. .	..	..	..	..	800
Two incubators and thormostate .. .. .	..	..	..	..	750
Two thermographs .. .. .	..	..	..	..	260
Two hygrographs .. .. .	..	..	..	..	320
Blackman's transpirometer .. .. .	..	..	..	..	700
Corks, rubber tubes, etc. .. .. .	..	..	..	..	400
Analytical balance .. .. .	..	..	..	..	800
Glass thermo regulators .. .. .	..	..	..	..	100
Miscellaneous .. .. .	..	..	..	..	3,000
					8,930
Total Agricultural C (Non-recurring) ..					8,930

*Agricultural C (Recurring).*

Staff and establishment.	First year.	Second year.	Third year.	Fourth year.	Fifth year.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
One research assistant with special knowledge of plant physiology (Rs. 150—25—250 per mensem).	1,800	2,100	2,400	2,700	3,000	12,000
One chemical assistant (Rs. 110—10—150 per mensem).	1,320	1,440	1,560	1,680	1,800	7,800
One trained fieldman Rs. 65 per mensem.	780	780	780	780	780	3,900
One laboratory assistant (Rs. 30—3—42 per mensem).	360	396	432	468	504	2,160
One attendant (Rs. 12—1—16 per mensem).	144	156	168	180	192	840
<i>Allowances.</i>						
Travelling allowance for visits to sugarcane growing and other research centres.	1,000	1,000	1,000	1,000	1,000	5,000
<i>Contingencies.</i>						
Miscellaneous expenditure on chemicals and glassware.	1,500	1,500	1,500	1,500	1,500	7,500
Total Agricultural C (recurring) ..	6,904	7,372	7,840	8,308	8,776	39,200

NOTE.—The staff demanded above for the agricultural part (A, B and C) of the scheme is required in addition to those already employed on the farm in charge of general supervision work. No money has been demanded for capital expenditure, as buildings, laboratories, gas plant and other necessary requirements already exist at Shahjahanpur.



## II.—TECHNICAL

*Details of expenditure (Annexure I).*

1. One cane-crushing plant consisting of two three-roller mills arranged in tandem. Size of rollers—12" dia.  $\times$  18" long, complete with double reduction compound gearing. Arranged for belt drive.
2. One oil engine, 50 B. H. P. (50-H. P. electric motor).
3. Two *rab* juice-receiving tanks size 3'  $\times$  3'  $\times$  3' complete with strainer.
4. One belt-driven centrifugal pump for mill juice, capacity 150 gallons per minute, complete with piping.
5. Three juice-collecting and measuring tanks—size 3'  $\times$  3'  $\times$  3' each, in one set.
6. Four sets of juice-boiling batteries, each capable of dealing with 125 maunds of juice per day, complete with fire grate, furnace doors, dampers and two chimneys, 20 feet high.
7. Two batteries of two pans each for reboiling molasses, complete with fire grate.
8. Set of ladles and hand strainers.
9. Eight brass wiremesh strainers, two for each battery of juice-boiling pans.
10. Guttering for juice from measuring tanks to boiling pans.
11. Two centrifugal machines, size of basket 18" diameter, belt-driven, having a maximum working speed of 2,100 B. H. P., each machine to have a separate oil engine, 2½ H. P.
12. 2,000 empty kerosine oil tins for *rab*.
13. Line shafting, plumber blocks, pulleys and belting.

	Rs.
Estimated cost .. .. .	17,000
<hr/>	
Total, Technical .. .. .	17,000
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## III.—ECONOMICAL (RECURRING).

*Details.*—In addition to the present staff of the Bureau, the following additional hands will be required for the investigation of agricultural marketing methods and practices in the United Provinces for a period of two years :—

	First year.	Second year.	Total.
	Rs.	Rs.	Rs.
One research assistant at Rs. 200 per mensem	2,400	2,400	4,800
Two investigators on Rs. 150 per mensem .. .. .	3,600	3,600	7,200
One clerk on Rs. 40 per mensem .. .. .	480	480	960
<hr/>			
Total Staff .. .. .	6,480	6,480	12,960
<hr/>			

Besides additional staff the following items will also be required in connection with the above investigation :—

<i>Allowances.</i>		Rs.	Rs.	Rs.
Travelling allowance for staff	.. ..	1,500	1,500	3,000
<i>Contingencies</i>	.. ..	500	500	1,000
<b>Total</b>		<b>2,000</b>	<b>2,000</b>	<b>4,000</b>
<b>Total, Economical (Recurring)</b>				<b>16,960</b>

*An abstract of the cost of the complete scheme.*

Name of the section.	Non-recurring.	Recurring.	Total.	Remarks.
	Rs.	Rs.	Rs.	
I.—Agricultural, A and B ..	6,000	88,720	94,720	Recurring in five years.
Do. C ..	8,930	39,200	48,130	Ditto.
II.—Technical .. ..	17,000	..	17,000	
III.—Economical .. ..	..	16,960	16,960	Recurring in two years.
<b>Total</b> ..	<b>31,930</b>	<b>1,44,880</b>	<b>1,76,810</b>	

#### ENCLOSURE II.

EXTRACT FROM PROCEEDINGS OF THE 4TH MEETING OF THE SUGAR COMMITTEE,  
HELD AT NEW DELHI ON TUESDAY, THE 8TH DECEMBER 1931.

*Application from the United Provinces Government for a grant of Rs. 1,76,810 for investigation into the problem of sugar industry in the United Provinces.*

Mr. Burt read the report of the Sub-Committee appointed to consider the various provincial schemes. The report was adopted.

The United Provinces Government have withdrawn the original proposal Subject 10, (not printed) as a comprehensive scheme has now been submitted (Enclosure I) after full consideration by the Provincial Research Committee.

#### I.—AGRICULTURAL.

Subject to the following modifications, the Sub-Committee recommend for sanction parts (a) and (b) of this scheme. The Director of Agriculture explained that the Shahjahanpur sugarcane research farm has been placed under the control of Mr. Sethi, Economic Botanist, United Provinces, who will be in charge of both rice and sugarcane research. Statistical assistance will be available from the Bureau of Economics in connection with the planning and interpretation of field experiments. The following reductions are recommended:—

- (1) Omission of the storekeeper's post,
- (2) Substitution of a clerk on Rs. 50—5—75 for a stenographer clerk;
- (3) Reduction of travelling allowances to Rs. 5,000 for the whole period of 5 years,
- (4) Reduction of provision of manures from Rs. 10,000 to Rs. 5,000.

This involves the reduction of the total grant of sections A and B to approximately Rs. 75,000 spread over 5 years.

As regards Agricultural c, physiological and chemical, the Director of Agriculture would like to reconsider the proposal for physiological work. The Sub-Committee emphasised that sub-section (c) (2) was the more important. The question of a further grant for chemical and physiological work may be examined a year later.

The Sub-Committee recommend the addition to the United Provinces scheme as now revised of provision for an Assistant Entomologist (or a Plant Pathologist) on a scale of Rs. 200—20—300 per mensem for investigation of sugarcane pests under the direction of the Government Entomologist.

#### II.—TECHNOLOGICAL.

##### (1) United Provinces :—

Mr. Srivastava explained that this was an experiment in the use of hydro-electrical power for sugarcane crushing and sugar manufacture and not an experiment with sugarcane crushers or in sugarcane boiling. The Sub-Committee enquired why the whole cost should not be met by the Hydro-electric circle of the Irrigation Department; it was explained that this would lead to indefinite delay and that the main object of the present scheme was the utilisation of electric current for agricultural purposes. The Sub-Committee recommend that the grant be sanctioned on the condition that the United Provinces Government will undertake to purchase the machinery at 75 per cent. of its cost at the end of the first year. The Sub-Committee desire to emphasise that as the object of the experiment is to ascertain the relative cost of electric motors and oil-engines

for this class of agricultural operation, full electrical records should be maintained and a report made to the Council on this point at the conclusion of the experiment.

In connection with this report Chowdhry Mukhtar Singh enquired if there was any co-ordination between the research schemes of the various provinces to which Mr. Burt replied that these schemes were the result of our previous decision to have a chain of research stations in the main sugarcane belt. Rao Bahadur Venkataraman referred particularly to the United Provinces scheme and the reference therein about Mr. Howard's book and the Indian Sugar Committee's report. He said that it was not essential that the breeding and the crossing work should be done in the area for which the sugarcane variety was needed, and in support of this he quoted the instance of canes bred in Demerara which were grown and used in Louisiana and also of cane bred in Java (P. O. J. 213) which was grown in Louisiana and Argentina. Similarly, the canes grown in Japan had been obtained from Java. There was no ground for the view that the actual production of crosses should be effected in the areas where they were to be grown. He added that Coimbatore canes were grown in Hawaii and Australia and was confident that some of them would suit the United Provinces. Mr. Noel Deerr endorsed this and said that he agreed with Rao Bahadur Venkataraman in every particular. Rao Bahadur Venkataraman also mentioned for the information of the Committee that he had been successful at Karnal in getting sugarcane seed to germinate in sub-tropical India and added that with proper technique, proper supervision and sown at the proper time it was quite possible to get sugarcane seed to germinate in Upper India and this made practically redundant the scheme which had already been sanctioned for Shahjahanpur to transport seedlings at a cost of Rs. 6,000. The 3rd point he mentioned was that he was now investigating the different times of sowings for Sorghum hybrids.

Mr. Burt referred to page 4 of the printed papers in connection with item 10 (a) and said that in view of the discussion on subject 4 it would seem sufficient to place on record that the agency for carrying out the investigation in connection with the cost of sugarcane cultivation should be the Board of Economic Enquiry in the United Provinces and its attached Bureau. This was approved.

#### ENCLOSURE III.

##### *Agricultural A and B (Non-recurring).*

	Rs.
Apparatus for recording discharge of water ..	.. 6,000
	<hr/>
Total Agricultural A and B (Non-recurring) ..	.. 6,000
	<hr/>

*Agricultural A and B (Recurring).*

Staff and Establishment.	First year.	Second year.	Third year.	Fourth year.	Fifth year.	Total.
One Assistant Sugarcane Expert (Rs. 250—25—750), Member of Provincial Service.	Rs. 3,000	Rs. 3,300	Rs. 3,600	Rs. 3,900	Rs. 4,200	Rs. 18,000
One Assistant Entomologist (or a Plant Pathologist (Rs. 200—20—300)).	2,400	2,640	2,880	3,120	3,360	14,400
Two Research Assistants (Rs. 110—10—150)—one in Botany and other in Agriculture.	2,640	2,880	3,120	3,360	3,600	15,600
One Assistant (Rs. 80—5—105) (will be in charge of drawings required to be made of plant material).	960	1,020	1,080	1,140	1,200	5,400
Two Laboratory Assistants (Rs. 30—3—42).	{ 360	396	432	468	504	2,160
	{ 360	396	432	468	504	2,160
Two Fieldmen (Rs. 30—3—42) ..	{ 360	396	432	468	504	2,160
	{ 360	396	432	468	504	2,160
One Clerk (Rs. 50—5—75) ..	600	660	720	780	840	3,600
Two Attendants (Rs. 12—1—16) ..	288	312	336	360	384	1,680
<i>Allowances.</i>						
Travelling Allowance for officers and subordinates (during the first year more travelling will have to be done for collecting varieties).	..	..	..	..	..	5,000
<i>Contingencies.</i>						
Research Farm Contingencies ..	3,000	3,000	3,000	3,000	3,000	15,000
Manures—Chemical and organic ..	..	..	..	..	..	5,000
Scientific literature ..	500	500	500	500	500	2,500
<b>Total Agricultural A and B (Recurring).</b>	..	..	..	..	..	<b>94,820</b>

## II.—TECHNICAL.

Estimated cost .. .. .	..	..	..	..	..	Rs. 17,000
Total Technical ..						17,000
Agricultural .. .. .	..	..	..	..	..	} or Rs. 1,17,820 in all over 5 years.
Technical .. .. .	..	..	..	..	..	
<b>Total ..</b>	..	..	..	..	..	

	Non-Recurring.	Recurring.
	Rs.	Rs.
Agricultural .. .. .	6,000	94,820
Technical .. .. .	17,000	..
<b>Total ..</b>	<b>23,000</b>	<b>94,820</b>

## APPENDIX XV.

SUBJECT No. 17.

## SCHEME FOR A RESEARCH AND TESTING STATION FOR THE INDIGENOUS SYSTEM OF GUR AND SUGAR MANUFACTURE.

At their 4th meeting held in December 1931, the Sugar Committee considered a scheme (Enclosure I) drawn up by the Sugar Technologist, Imperial Council of Agricultural Research, for the establishment of a research and testing station for the indigenous system of gur and sugar manufacture and recommended that the scheme involving a capital expenditure of Rs. 76,000 and a recurring expenditure of Rs. 91,380 or a total expenditure of Rs. 1,67,380 spread over a period of five years be sanctioned (Enclosure II). The Government of the United Provinces approve of the proposal to work the scheme in the United Provinces under the supervision of the Sugar Technologist.

The scheme is now for the consideration of the Advisory Board.

T. VIJAYARAGHAVACHARYA,

Secretary.

The 28th December 1931.

## ENCLOSURE I.

COPY OF A LETTER No. 1414, DATED THE 4TH AUGUST 1931, FROM THE SUGAR TECHNOLOGIST, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, CAWNPORE, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, S.-W.

I have the honour to enclose herewith a scheme, drawn up by me, for a research and testing station for the indigenous system of gur and sugar manufacture. If approved, this may be referred to the Sugar Committee.

*Scheme for a Research and Testing Station for the indigenous system of gur and sugar manufacture, by R. C. Srivastava, Sugar Technologist to the Imperial Council of Agricultural Research, Cawnpore.*

1. *Aims and Objects.*—The present scheme aims at providing an experiment station, properly staffed and equipped, and located in a suitable centre, for the purpose of testing existing processes and machinery used in manufacturing gur, rab and sugar by the indigenous systems, for conducting trials of new plant and processes, and for undertaking research work for introducing improvements.

2. *Importance of the indigenous system of gur and sugar manufacture.*—According to the figures given by the Tariff Board for the 1927-28 crop (see "Report of the Indian Tariff Board on the Sugar Industry" 1931, page 44), out of 35.2 million tons of cane grown in India, approximately 2 per cent. was used for the direct manufacture of white sugar in factories, 11 per cent. for the manufacture of white sugar by the *bel* process and over 72 per cent. for the manufacture of gur, the balance of about 15 per cent. being used up as sets and for chewing. The indigenous processes therefore accounted for 83 per cent. of the cane as against only 2 per cent. utilized by the factories. From the point of view of the grower of cane the former processes are consequently of far greater importance and any measures adopted for increasing their efficiency will directly benefit the agriculturist.

3. *Necessity for a Research and Testing Station.*—The two sections of the Indian sugar industry—the factory industry and the indigenous industry—differ from one another in one important respect. The plant and process used in the factory industry in India are similar to those used in other cane growing countries. They are the products of generations of research and experience of several countries,—notably Java, Hawaii, the United States of America, and the beet sugar producing countries (particularly Germany). The problems of the factory industry peculiar to India are few and the necessity and urgency for scientific research is correspondingly less.

The case is however entirely different with the indigenous sugar and *gur* industry. This has no parallel or counterpart in any other country of the world. The process is unknown in other countries and the technologists there have no interest in studying it. In this branch of the industry therefore India is deprived of the benefit of the researches and accumulated experience of foreign workers which she gets in the factory industry. There is a similar difficulty in regard to machinery for the indigenous industry. The foreign machinery makers have no idea of the special requirements of this industry and consequently the machinery supplied by them is not always quite suitable. What is still more important, they do not know that the people who have to use the machines in this country have very limited means and hence whilst endeavouring to increase the efficiency of the machines they frequently lose sight of the vital importance of low initial cost.

It is obvious therefore that the problems of the indigenous industry have to be solved in India and very little outside help can be counted upon. From the point of view of lowering the initial cost, it is almost certain that the equipment will have to be of Indian make, and of such simple types that the greater part of it can be made and repaired in the villages. To do this a Central Research and Testing Station of the type proposed in this note and located in the centre of the industry is essential.

4. *Lack of fundamental data.*—The most noticeable feature which strikes one when attempting to investigate problems connected with the indigenous processes is the complete absence of fundamental or basic scientific data. A good deal of work has, it is admitted, been done in the past by different workers in this field, but most of it has been of an empirical nature based on a system of trial and error. The first attempt at collecting scientific data was made at Bilari, but as the tests there were being conducted primarily on commercial lines and as the staff and equipment provided were sufficient only for the purpose, the opportunities afforded were necessarily restricted. But what little was done was sufficient to bring into sharp relief the lack of scientific information of even the most essential nature, so much so that it is almost impossible to accurately visualize the problems which await enquiry.

One possible explanation of the haphazard methods of investigation employed in the past is that as the industry is run on crude and antiquated lines, it was felt that it was not a fit subject for exact scientific investigations. The argument is obviously fallacious. The theoretical principles underlying a machine are the same whether it is small in size or large and whether it is intended for use in a cottage industry or in a large organised industry. Thus, for instance, it is just as important to have the stresses in a cane mill correctly balanced whether it is a tiny unit or a large mill. Similarly the conditions for efficient combustion are the same whether bagasse is being burnt in small quantities in a *bel* furnace or *en masse* in the furnace of a large boiler. To give another example, the juice is susceptible to decomposition precisely in the same manner whether it is treated in

the small pans of a *bel* or in the large tanks of a factory. To understand the defects and to devise methods for rectifying them, there is therefore just as much need for the adoption of precise scientific methods in one case as in the other.

5. *Training of artisans.*—The Bilari experiments have shown that even the existing plant and processes can give better results if the methods employed are carefully controlled by properly trained workmen. A great deal of the higher efficiency of the Bhopal process was due to the skill and long experience of the men employed during the test.

It is therefore necessary to have a supply of properly trained men, if the industry is to develop on efficient lines. The proposed research station should, as part of its normal work, train artisans for this purpose. The training imparted should be of an entirely practical nature. Experience shows that industrial and agricultural schools are not suitable for this purpose as they lack the proper commercial atmosphere and the men coming out of them are apt to consider themselves above doing manual work.

6. *Testing of plant and process.*—There is large variety of machinery for the indigenous industry on the market. These differ widely in price efficiency and durability. But apart from the claims made in respect of them by their dealers, the buyer has no means of knowing their real merits. Very often the buyer fails to get satisfactory results with the machines he has purchased and it is then difficult for him to ascertain whether this is due to defects in the machines themselves or whether the erection and method of operating are at fault. It is not unusual in such cases to put the blame on the machinery maker.

It should be one of the functions of the proposed Research Station to test and report on machines and processes offered to the public. In this way the expert opinion of an impartial body will be available to dealers and users both and will enable them to correctly appraise the merits of the various processes and the different types of plant available for him to choose from.

A certain amount of work of this kind is at present being done by some of the provincial departments, but there is not sufficient collaboration and co-ordination. The Research Station should make full use of this work and should, in fact, serve as a clearing house for all the information available.

7. *Devising complete plants.*—The Research Station should also devise complete plants of different capacities, suitable for the indigenous industry. There is no single firm at present which can supply such complete plants and the buyer has to go to different dealers before he can get a complete equipment. Plant purchased in this manner is very often unbalanced, resulting in inefficient and uneconomic working for which none of the suppliers will accept responsibility. If, however, specifications for complete plants are worked out at the Research station and the plants are tested there, it should be easy for engineering firms to take up their manufacture.

8. *Utilisation of Electric power from the hydro-electric system.*—There is cheap electric power available now in those parts of the United Provinces where this industry is mostly established. If suitable arrangements can be made in collaboration with the provincial department concerned, tests can be made to determine the economy which will result from the use of electric power and machinery can be devised for a more extensive utilization of such power.

9. *Demonstration.*—Another important function of the Research Station should be to give demonstrations of new machines and improved processes. The station will have to be located in a suitable centre and should be easily accessible.



Arrangements will also have to be made for sending out peripatetic demonstration parties to important centres.

10. *Location of the Research Station.*—The proposed Research station should be started at a suitable centre in the western part of the United Provinces—Meerut, Muzaffarnagar, Bareilly, Moradabad and Bijnor being the more important places from which a selection may be made. The exact site selected should be on a main road and preferably near a railway station. No enquiries for a site have yet been made, but no difficulty is apprehended in getting a suitable site after the scheme has been sanctioned.

The Imperial Council of Agricultural Research has given a grant to the Government of the United Provinces for an experimental sugar factory at the Harcourt Butler Technological Institute, Cawnpore. The advisability of locating the proposed research station at Cawnpore so that it may work in conjunction with the experimental factory was considered, but had to be ruled out for the following reasons :—

- (a) Cawnpore is too far from centres of the *khandsari* industry ;
- (b) Cawnpore is not a cane growing centre, and the results obtained with the cane grown near Cawnpore may not always be applicable to the conditions obtaining in places where the *khandsari* industry is established ;
- (c) The experimental factory at Cawnpore is intended for research and instructional work in connection with the factory industry and has not very much in common with the plant and processes used in the indigenous methods of sugar manufacture. If any special problems in connection with the latter arise which need to be studied in the experimental factory, there will be no difficulty in doing this as it is one of the conditions of the grant given by the Research Council that the Sugar Technologist will be in charge of the experimental factory and will control the programme of experimental work in it.

11. *Supply of raw material and disposal of finished products.*—An important point to be taken into consideration in selecting a site for the research station will be the facilities available for the supply of raw material and the disposal of finished products. The station will not have its own cane plantation as this is unnecessary for the kind of work it has to do and will add considerably to the cost of the scheme.

The following alternative arrangements are suggested in this connection :—

- (a) Supplies of cane may be obtained from the owner of a private farm and the finished products (*gur* or *rab* or sugar and molasses) returned to him, charging for manufacturing expenses at rates previously settled ;
- (b) The cane may be purchased from neighbouring farms or cultivators on payment of price according to contracts previously made, and the finished products sold in the market ;
- (c) The cane may be taken and the finished products given back on a co-operative basis. The Registrar of Co-operative Societies, U. P. is organizing such societies in some parts of the province, and it is likely that if he is approached he would be willing to assist in

the formation of a society to work in conjunction with the Research Station.

It will not be desirable to arrange for obtaining supplies of cane from an experimental farm of the Department of Agriculture, as these farms are primarily intended for growing cane for distributing seed.

12. *Staff*.—Normally a Research Station of this kind, if it had been an independent institution, would have required a highly qualified technologist at its head. In the present case, however, as the station will be under the direct charge of the Sugar Technologist, it is necessary only to provide suitable assistance to work under him.

Details of the proposed staff are given in Statement II, and full explanatory notes are given later on in connection with the proposed budget estimate. The staff will be partly permanent, employed all the year round, and partly temporary engaged for the sugar making season of about six months in the year. In the former category are included the technical men (Chemist and Engineer), a *Mistri* to look after the machinery, and a clerk to attend to the office work. The temporary seasonal establishment consists of the operative and supervising staff.

During the off season when cane crushing is stopped, the permanent staff will be engaged in calculating results of experiments conducted during the season, preparing reports, overhauling the plant, making changes in the light of the experiments previously conducted, and assisting in the designing and erection of improved types of plant. A certain amount of experimental work for which cane juice is not required will also be done during the off season.

13. *Equipment*.—Statement I gives particulars of the equipment which will be required. This will comprise a laboratory, a repair shop and machinery of different types used in the indigenous process. A detailed description of the equipment required is given in a subsequent paragraph.

14. *Programme of experimental work*.—It is not possible to lay down in advance a complete programme of work because many problems will be discovered only after the work has been commenced. In a general way it may be stated however that the plan of work will be at first to collect data, relating to the processes as commonly followed and to investigate the cause of defects so far as these are known at present. Later on such problems will have to be taken up as this preliminary study discloses and finally trials will be made of improved machinery and processes devised as a result of these investigations.

An outline of the preliminary work indicated above, which should take up the first two or three years, is given below. This is however subject to amendment in the light of experience gained as the work progresses:—

#### A.—CANE CRUSHING :

- (i) Testing Cane Mills at present on the market.
- (ii) Designing improved types of cane mills, having 3, 5, 6 and 9 rollers.
- (iii) Trying the effect of different pressure and roller speeds and of different shapes and sizes of grooving on the capacity and extraction of cane mills.
- (iv) Improvements in the methods of feeding cane to secure uniformity.
- (v) Introduction of maceration within the limits of fuel available.

- (vi) Devising simple types of juice pumps.
- (vii) Use of disinfectants in cane mills, juice tanks, pipes, etc.

**B.—MOTIVE POWER :**

- (i) Hydro-Electric power.
- (ii) Suction gas.
- (iii) Steam from waste heat of *bels*.
- (iv) Different types of oil engines.

**C.—JUICE AND MOLASSES BOILING :**

- (i) Obtaining complete technical data regarding the more important types of juice and molasses boiling plants and correlating these with efficiency and economy of working.
- (ii) Testing and perfecting the improved type of *bel* as recommended in the report on the Bilari experiments.
- (iii) Studying the open pan systems of sugar manufacture as used in the West Indies, the United States and the Phillipine Islands and ascertaining whether any modifications of these can be used under Indian conditions.
- (iv) Use of Suction gas for boiling purposes.
- (v) Use of vacuum pans in conjunction with direct-fired *bels*.
- (vi) Improving the design of *bel* furnace for burning partially moist bagasse.

**D.—CLARIFICATION :**

- (i) Testing present indigenous clarifying agents.
- (ii) Trying new indigenous clarifying agents.
- (iii) Devising a simplified form of liming and sulphitation process suitable for the *khandsari* industry.

**E.—CRYSTALLIZATION :**

- (i) Use of a modified form of oscillator.
- (ii) Use of metal and wooden vessels of different types for cooling and crystallization of *rab*.

**F.—PUGMILLS AND CENTRIFUGAL MACHINES :**

- (i) Designing a simple type of wooden pugmill to prevent breaking of crystals.
- (ii) Devising a special type of electrically driven centrifugal machine with the motor forming an integral part of the machine.
- (iii) Testing different types of screens in centrifugals, with *rabs* of varying textures.
- (iv) Determining optimum speeds of centrifugal basket for *rabs* of different consistencies.
- (v) Application of simplified form of double curing process to *rab*.

## G.—SUGAR DRYING :

Designing a simple type of wooden sugar dryer to take the place of the present system of drying in the sun. Air to be heated by chimney gases and a hand blower to be used.

## H.—Gur MANUFACTURE :

- (i) Designing a pan for the continuous boiling of gur.  
 (ii) Improving the keeping quality of gur by eliminating the entrained molasses and reducing the final acidity.

15. *Estimate of Cost.*—Two schedules showing details of cost are given in Statements I and II attached. A summary of these is given below :—

Year.	Capital expenditure.	Recurring expenditure.	Total.
	Rs.	Rs.	Rs.
First year .. .. .	52,000	17,796	69,796
Second year .. .. .	6,000	18,396	24,396
Third year .. .. .	6,000	18,996	24,996
Fourth year .. .. .	6,000	19,596	25,596
Fifth year .. .. .	6,000	20,196	26,196
Total ..	76,000	94,980	1,70,980

Explanatory notes on the various items of expenditure are given in the following paragraphs.

16. *Capital Expenditure.*—(a) *Land* : About four or five acres of land will be required for the buildings and also to provide space for drying bagasse and sugar and keeping supplies of cane and fuel. As the work is of a temporary nature, an attempt will be made to take the land on rent, in which case this item of expenditure will be substantially reduced.

(b) *Buildings* : One shed will be required for housing the machinery (consisting of cane mills, engine, pugmills and centrifugal machines) and another

shed for *bela* of different types, for boiling juice and molasses. A godown, suitably partitioned will be required for storing *rab*, *gur*, sugar, molasses and sundry stores. For housing the laboratory and office a block consisting of two rooms and a verandah will be provided. A small shed for accommodating the fitters' repair-shop completes the list of buildings. Wire fencing will be used in place of a boundary wall round the buildings.

As the experiment station will be on a temporary basis, all buildings will be of cheap design. Complete plans and estimates will be submitted for approval before construction work is taken in hand.

(c) *Laboratory equipment* : A good laboratory is an absolute necessity for proper scientific control of manufacturing and experimental work. Such a laboratory will however cost a great deal of money. The provision made in the budget will cover the cost of the essential apparatus and material and will permit of such additions each year as may be found to be necessary for the research work in hand at the time. It is likely that for some researches costly instruments may be required. Instead of purchasing these, attempt will be made to obtain them on loan from other laboratories.

(d) *Repair Shop equipment* : A small fitters' workshop and smithy will be required for the maintenance of the plant and for making alterations necessary for experimental purposes. It will be cheaper and more convenient to have this work done at site than to send it out to engineering firms.

(e) *Machinery* : In order that the Research Station may be in a position to compare the different types of machines in use and to make improvements in them, it is necessary that it should be equipped with as wide and representative a set of these machines as possible, such a set will however involve considerable expenditure. The list of machinery given in the budget is the minimum that will be required for this purpose. It is hoped that most manufacturers of machinery will send machines free of charge for testing and demonstration purposes and hence much of the expense, that would have been incurred in purchasing a complete set of machines, will be saved.

The annual lump sum provisions made in the budget for machinery in the four years after the first year are to cover the cost of new types of machines which may be purchased and of making machines according to designs evolved at the Research Station.

(f) *Furniture and fittings* : The provision under this head is to cover the cost of the minimum quantity of furniture and fittings for the office, laboratory and factory.

(g) *Water Supply* : The provision made for water supply is only tentative and approximate : the exact requirements cannot be ascertained till the site has been selected and the source from which water is to be obtained (*e.g.*, from tube well, from ordinary type of well with pump or from public water supply) is known.

(h) *Lighting arrangement* : For working at night electric light (if available) or Kitson lights and hand lanterns will be necessary.

(i) *Contingencies and Miscellaneous expenses* : These are to cover sundry unforeseen expenses.

17. *Recurring Expenditure* :—(a) *Establishment* : Particulars of the qualifications and duties of the permanent staff are given below :—

- (i) *Chemist* : The chemist should have received training in Sugar Technology in a recognized institution in India or abroad and should possess at least five years' experience in a sugar factory as manufacturer and chemist. Knowledge of the plant and process employed in the indigenous sugar and *gur* industry should be treated as useful additional qualification.

During the off-season the chemist will continue his work in the experimental factory and chemical laboratories of the Technological Institute, Cawnpore, under the direction of the Sugar Technologist.

- (ii) *Engineer* : An engineering graduate or diploma holder, with some works experience should be employed for this post. He should be capable of making simple engineering tests—*e.g.* power consumption, evaporation, heat balance, etc.—and should be able to erect, adjust and maintain the various machines, and to look after the workshop.

After the sugar making season, he will be employed in overhauling the machinery, making alterations to plant, assisting in the preparation of designs of new plant, supervising their manufacture and erecting them.

- (iii) *Mistry* : A mechanic with experience of oil engines, electric motors, cane mills and centrifugal machines will be required for attending to these machines. During the off-season he will work under the Engineer in overhauling the plant and erecting new machines.
- (iv) *Clerk-Accountant* : The office establishment will consist of one clerk who will attend to accounts work also. The clerk should have knowledge of accounts and typing.

- (v) *Inferior Servants* : Provision has been made for one *chaprasi* and one *chowkidar*.

(b) *Seasonal Establishment*.—(i) *Assistant Chemists* : Two junior chemists, with experience of sugar factory laboratories will be required during the manufacturing season for doing routine analyses, maintaining technical records and supervising experiments.

(ii) *Mistries* : During the working season, when all the machines are in use, two *mistries* (in addition to the one permanent *mistri*) will be required to keep them in proper order and to carry out urgent repairs when necessary.

(iii) *Clerk* : One extra clerk will be required during the working season to attend to the additional work in connection with purchase of raw material, stores, etc., and sale of finished products, maintaining attendance registers, records of consumable stores and other miscellaneous work.

(iv) *Weightment Clerks* : For all experimental work it is essential that raw material and finished products as well as the more intermediate products and fuel should be regularly weighed. Three weightment clerks will be required for this purpose.

(v) *Supervisors* : To ensure that work is carried out in strict accord with the prescribed experimental conditions, the services of educated supervisors will be required. Three such supervisors have been provided.

(vi) *Bel Karigars* : Four *bel karigars* (sugar boilers) will be required for working the juice and molasses boiling pans.

(vii) *Centrifugal men* : Two men will be required for operating the centrifugal machines—one for First Sugar and another for Second Sugar.

(viii) *Workmen* : The number of workmen required will vary according to the amount and nature of work in hand at the time. Moreover, it will be necessary and economical in some cases, to engage certain types of operatives for the entire season on a monthly basis, whilst the ordinary unskilled labour can be employed on daily wages. It is estimated that on an average 30 workmen will be required.

(c) *Allowances and Honoraria*.—The provision under this head is to meet the travelling expenses of the staff for journeys to and from Cawnpore in connection with work during the off-season, and for visits of demonstration parties to different centres.

(d) *Supplies and Services*.—This sub-head covers a gross provision of Rs. 20,000 for commercial operations, and allows for recoveries each year of Rs. 18,000 the net expenditure therefore being Rs. 2,000. The object of providing funds in this manner is twofold—firstly it permits of an arrangement similar to a revolving bank credit, under which money is drawn according to requirements and sale proceeds are credited into the treasury so that no large amounts are outstanding at any time, and secondly by limiting the net annual expenditure to Rs. 2,000, it is made obligatory to sell the finished products and realise other assets promptly.

(e) *Contingencies*.—The items under this sub-head are self-explanatory. It may be pointed out however that the provision of Rs. 2,000 for "repairs and modification of plant" is distinct from the provision of Rs. 5,000 annually under "Machinery" in the budget estimate of capital expenditure. The former item covers expenses in connection with repairs and alterations to existing machinery which do not increase the value of the assets and cannot therefore be charged to capital account. The latter item, on the other hand, covers additions to plant which are chargeable to capital account.

18. *Necessity for flexibility*.—As pointed out in connection with the programme of experimental work, it is not possible in a research station of this kind, to lay down an exact programme of work, because new problems arise as work progresses. It is evident therefore that, under such conditions, the expenditure cannot be expected to be strictly in accordance with a rigid budget. In sanctioning the budget a certain measure of flexibility may therefore be permitted, provided the total expenditure does not exceed the budgeted amount.

19. *Recoveries on completion of work*.—The present proposal is for a Research Station for five years. On completion of this period, unless it is decided to continue the work further, all the machinery, buildings and other material will be disposed of, resulting in the realization of a substantial amount. This should materially reduce the total cost of the scheme. No exact estimate of this can however be given at this stage.

R. C. SRIVASTAVA,

*Sugar Technologist.*

CAWNPORE :

The 31st July 1931.

LIICAR

Statement I.—Capital Expenditure for the proposed Research and Testing Station for the indigenous gur and sugar industry.

Serial No.	Heads and items.	I Year.	II Year.	III Year.	IV Year.	V Year.
		Rs.	Rs.	Rs.	Rs.	Rs.
1	Land—4 to 5 acres .. ..	1,000				
	Buildings:—					
	(a) One shed for cane mills, engine, pugmills and centrifugal machines, 30' × 50'.	3,750				
	(b) One shed for boiling <i>bels</i> , 30' × 50'.	3,750				
	(c) One godown (suitably partitioned) for <i>rab</i> , <i>gur</i> , sugar, molasses and stores, 30' × 50'.	4,500				
	(d) Laboratory (20' × 15') and office (15' × 15') with verandah 8' wide.	2,700				
	(e) Shed for repair shop, 15' × 35'	1,300				
	(f) Wire fencing and gates ..	1,000				
3	Laboratory equipment .. ..	4,000	1,000	1,000	1,000	1,000
4	Repair shop equipment .. ..	3,000				
5	Machinery—					
	(a) Bullock cane mills .. ..	200				
	(b) Power driven cane mills ..	5,000				
	(c) Oil engines .. ..	5,000				
	(d) Juice pumps .. ..	1,000				
	(e) Juice boiling <i>bels</i> .. ..	1,000				
	(f) Molasses boiling <i>bels</i> ..	200				
	(g) Pugmills .. ..	700				
	(h) Centrifugal machines .. ..	1,000				
	(i) One 3-ton weighbridge .. ..	1,500				
	(j) One 1-ton weighbridge .. ..	1,000	5,000	5,000	5,000	5,000
	(k) One 5-cwt. weighbridge ..	600				
	(l) One beam scale with weights ..	100				
	(m) Kerosene tins .. ..	350				
	(n) Tanks for juice, <i>rab</i> molasses, etc.	500				
	(o) Crystallizers of metal and wood	500				
	(p) Ladles, Sieves, Strainers, etc.	250				
	(q) Piping, shafting, pulleys, belting, etc.	1,500				
	(r) Foundations and erection of plant.	1,000				
6	Furniture and Fittings .. ..	500				
7	Water Supply .. ..	1,500				
8	Lighting arrangements .. ..	200				
9	Contingencies and Miscellaneous expenses.	2,400				
	Total .. ..	52,000	6,000	6,000	6,000	6,000
	Grand total for five years ..	76,000				



Statement II.—Recurring Expenditure for the proposed Research and Testing Station for the indigenous gur and sugar industry.

Serial No.	Heads and items.	I Year.	II Year.	III Year.	IV Year.	V Year.
		Rs.	Rs.	Rs.	Rs.	Rs.
1	Pay of Establishment—					
2	(a) Chemist (250—25—500) ..	3,000	3,300	3,600	3,900	4,200
	(b) Engineer (125—15—275) ..	1,500	1,680	1,860	2,040	2,220
	(c) Mistri (50—5—100) ..	600	660	720	780	840
	(d) Clerk-Accountant (50—5—100) ..	600	660	720	780	840
	(e) Chaprasi Rs. 12 ..	144	144	144	144	144
	(f) Chowkidar Rs. 11 ..	132	132	132	132	132
	Total ..	6,976	6,576	7,176	7,776	8,376
2	Pay of Seasonal Establishment (6 months per year)—					
	(a) Two Assistant Chemists at Rs. 50.	600	600	600	600	600
	(b) Two Mistris at Rs. 30 ..	360	360	360	360	360
	(c) One Clerk at Rs. 30 ..	180	180	180	180	180
	(d) 3 Weighment Munahis at Rs. 15.	270	270	270	270	270
	(e) 3 Supervisors at Rs. 15 ..	270	270	270	270	270
	(f) 4 <i>Bel Karigars</i> at Rs. 30 ..	720	720	720	720	720
	(g) 2 Centrifugal men at Rs. 20 ..	240	240	240	240	240
	(h) 30 Workmen at Rs. (12) or 6 annas per day.	2,160	2,160	2,160	2,160	2,160
	Total ..	4,770	4,770	4,770	4,770	4,770
3	Allowances and Honoraria— Travelling Allowance of Establishment.	250	250	250	250	250
4	Supplies and Services— Commercial Operations*	2,000	2,000	2,000	2,000	2,000
5	Contingencies—					
	(a) Stores and lubricants ..	500	500	500	500	500
	(b) Fuel ..	500	500	500	500	500
	(c) Chemical clarifying agents and manufacturing materials.	500	500	500	500	500
	(d) Consumable stores for laboratory.	500	500	500	500	500
	(e) Repairs and modifications, of plant.	2,000	2,000	2,000	2,000	2,000
	(f) Tools and tackle ..	100	100	100	100	100
	(g) Maintenance of buildings ..	250	250	250	250	250
	(h) Stationery ..	250	250	250	250	250
	(i) Postage and telegrams ..	100	100	100	100	100
	(j) Miscellaneous contingencies ..	100	100	100	100	100
	Total ..	4,800	4,800	4,800	4,800	4,800
	Grand Total ..	17,796	18,396	18,996	19,596	20,196
	Grand Total for five years ..					94,980

\*NOTE.—This comprises:—

Gross Expenditure Rs. 20,000

Recoveries .. .. 18,000

Net Expenditure .. .. 2,000

## ENCLOSURE II.

EXTRACT FROM THE PROCEEDINGS OF THE 4TH MEETING OF THE SUGAR COMMITTEE,  
HELD AT NEW DELHI, ON TUESDAY, THE 8TH DECEMBER 1931.

SCHEME FOR A RESEARCH AND TESTING STATION FOR THE INDIGENOUS SYSTEM OF  
GUR AND SUGAR MANUFACTURE DRAWN UP BY THE SUGAR TECHNOLOGIST,  
IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

The Chairman pointed out that these proposals arose out of the report on the Bilari experiments. Mr. Mehta suggested that a short pamphlet based on the Bilari report should be printed in Urdu and Hindi. This was agreed to and Mr. Srivastava was asked to prepare this pamphlet.

Rao Bahadur Venkataraman proposed that the thanks of the Sugar Committee should be communicated to Khan Bahadur Hadi and the Bhopal Durbar. Mr. Srivastava seconded this proposal which was carried unanimously. The Committee also wished to convey their thanks to Mr. Har Sahai Gupta for the invaluable assistance which he had rendered in carrying out this experiment.

Mr. Mehta proposed and Khan Bahadur Fateh-ud-Din supported that the scheme as put forward by Mr. Srivastava be adopted. They said that this scheme was the logical result of the appointment of the Sugar Technologist. The scheme as presented to this Committee had been worked out fully in all details and needed no further comments. Subject to the budget details being scrutinized by the Vice-Chairman, the scheme was approved.

In connection with this scheme Mr. Burt asked if the United Provinces Government's attitude had been ascertained on the proposal to establish a research station in the United Provinces under the direct control of the Research Council. Mr. Mehta, replying in the negative, said that he felt sure that the United Provinces Government would welcome it. It was agreed that the Committee's support to the scheme was conditional on the United Provinces Government's cordial approval. The Chairman asked Messrs. Noel Deerr and Millar as to their opinion on the scheme. Mr. Noel Deerr said that in the present Indian Sugar Industry there was the large industrialist or the factory owner and the small grower and he said that the *khandsari* was an intermediate stage and as an intermediate step in progress it was important to develop the *khandsari* industry. He said that although the *khandsari* was inimical to the interests of the large proprietor still he was of the opinion that steps should be taken to protect the small grower and he agreed with the general principles of the scheme. Mr. Millar, agreeing with Mr. Noel Deerr, added that the *gur* industry was a separate problem and it needed the support of this Committee. Mr. Burt next enquired if it was not possible to work the scheme in conjunction with the Harcourt Butler Technological Institute at Cawnpore to which the Imperial Council of Agricultural Research had made a substantial grant for sugar technology. There was something to be said for the view that such an industrial research experiment should be carried out where chemical and engineering assistance was readily available. Mr. Srivastava did not see much benefit in locating this research station at Cawnpore. He said that there would practically be no saving in building or in machinery. Moreover, his idea was to train men and carry on demonstrations in the improved methods of the *khandsari* industry and from that point of view it was necessary to have this work carried out somewhere in the centre of the *khandsari* industry, especially as no special engineering help was needed, for the plant which he proposed to put up could either be repaired and altered in the villages or could

not be repaired and altered even in Cawnpore. In answer to Mr. Burt he said that the Portable Sugarcane Mill referred to in the Harcourt Butler Technological Institute scheme had been designed and ordered and he expected the Mill at Cawnpore in a month's time. Mr. Burt enquired if it would be feasible to put this research station at Shahjahanpur adjoining the Sugarcane Research Station. Mr. Srivastava was of the opinion that Shahjahanpur was not such an important centre for the *khandsari* industry as Bareilly or Moradabad. Mr. Burt asked if the supply of cane to the experimental plant could be guaranteed. The old experiments at Nawabganj in the United Provinces had failed largely because of inadequate cane supply. Chowdhry Mukhtar Singh offered to supply 20,000 maunds of cane per annum in connection with this research scheme, provided the plant was located at Meerut. He said that he would supply the cane and take back the finished product so that the expense of purchasing cane and also the difficulty of selling the produce will be eliminated. It was agreed that before the location of the research station was decided the cane supply will have to be guaranteed and this question also was left to the Vice-Chairman for final decision. Mr. Burt then read a note (not printed) prepared on this research scheme by Mr. Milne who had suggested that this scheme may be amalgamated with the Punjab research scheme (*vide* subject No. 14 of Agenda, Advisory Board, 1932), for, in his opinion, there was a well equipped Engineering Section and College Laboratory to co-operate. Mr. Srivastava however was against amalgamating the scheme. Moreover he said that Lyallpur would be inconvenient from his point of view. In the end it was decided to record Mr. Milne's note.

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## APPENDIX XVI.

SUBJECT No. 16 (a).

## SCHEME OF RESEARCH ON SUGARCANE IN THE MADRAS PRESIDENCY.

Attention is invited to the attached letter (Enclosure I), from the Government of Madras, No. 1342-III-31-7, dated the 11th November 1931 forwarding a scheme of research on sugarcane.

A copy of a note on the scheme, dated the 19th November 1931, by the Agricultural Expert to the Imperial Council of Agricultural Research is enclosed (Enclosure II). This note was forwarded to the Secretary to the Government of Madras, Development Department. His reply will be found in Enclosure III.

The Sugar Committee considered this scheme at their fourth meeting held in December 1931 and their recommendations are attached (Enclosure IV).

The scheme is now submitted to the Advisory Board for (i) any further suggestions that the Board may have to offer and (ii) its endorsement of the recommendation of the Sugar Committee. As a new scheme has to be prepared, it is not necessary at this stage to go into financial details fully.

The revised scheme, when received from the Government of Madras, will be placed before the Sugar Committee (by circulation, if possible). It is therefore for consideration whether the revised scheme, if approved by the Sugar Committee, should again come before the Advisory Board before being referred to the Governing Body.

T. VIJAYARAGHAVACHARYA,

*Secretary.**The 4th January 1932.*

## ENCLOSURE I.

COPY OF A LETTER FROM THE SECRETARY TO THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 1342-III-31-7, DATED THE 11TH NOVEMBER 1931.

*Scheme of research on Sugarcane.*

With reference to Mr. Hydari's letter No. 956|Agri., dated 2nd May 1931 (not printed), I am directed to enclose a Scheme of Research on Sugarcane submitted by the Director of Agriculture, Madras. I am to commend it for the consideration of the Imperial Council of Agricultural Research. It will be observed from the Director of Agriculture's report that the scheme costs Rs. 2,56,900 out of which Rs. 1,06,800 may be accepted as contribution by this Government.

*Scheme of the Director of Agriculture.*

I have the honour to state that the Government in their letter No. 1153, dated the 9th July 1929 (not printed) to the Government of India said that "this Government consider that the needs of the Presidency are now adequately provided for as the Imperial Sugarcane breeding station at Coimbatore has been extended to deal with thick canes and a sugarcane testing station has been established at Anakapalle in charge of a gazetted officer where considerable progress

has already been made with local problems". Since that statement was made, there has been a happy change in the policy of Government as exemplified in their support for an economic enquiry into the cost of sugarcane cultivation in the Madras Presidency [*vide* No. 158 Ms., dated the 5th February 1931 (not printed)]. The reason for this change was mainly due to having realised the futility of raising paddy in extensive areas with prices at such a low ebb. A change in the local practice was found essential to meet the new situation, and sugarcane offered an excellent substitute giving more handsome returns. In fact, it is a happy augury of the future that the Irrigation Development Board has under its consideration the advisability of utilising the Lower Bhavani irrigation project in the Coimbatore district for the irrigation of dry crops rather than for paddy as had been the policy all along. In these changing circumstances, sugarcane will undoubtedly play an important rôle. Besides, sugarcane is an important cash crop of the Presidency. It takes a prominent place both in acreage and yield among the main sugarcane producing provinces of the country. While several crops have their specialists, sugarcane, despite its importance, has had to get on without one due to financial depression.

2. The area under cane in the Presidency during the last decade has had chequered career. There is no doubt that during the last few years it has gone down as shown below :—

Year.	Acres.
1920-21 . . . . .	103,823
1921-22 . . . . .	119,313
1922-23 . . . . .	131,095
1923-24 . . . . .	121,298
1924-25 . . . . .	110,360
1925-26 . . . . .	112,821
1926-27 . . . . .	114,495
1927-28 . . . . .	105,950
1928-29 . . . . .	89,075
1929-30 . . . . .	98,107

Apart from economic causes which would affect a world crop like sugarcane there are other causes contributing to the restriction in area. Want of initial capital, high cost of production, limitations with regard to soil and water-supply, low prices, are some of them. Poor quality canes, periodical visitations of insect pests and diseases, narrow rotations, uneconomic cultural methods, wasteful irrigation practices, crude methods in the manufacture of jaggery add their quota.

3. Although Agricultural Research Station, Anakapalle, has been recognised as the sugarcane research station of the Presidency, research work has not been confined to sugarcane alone ; similar work on paddy and ragi has been going on simultaneously. Progress in fundamental and agronomic research has been tangible, but it has been confined to local problems. Besides, Anakapalle represents only the district of Vizagapatam with 35,000 acres under sugarcane—the largest in the Presidency. Chittoor district with 10,800 acres next claims our attention. Coimbatore district, and other tracts in the Cauvery valley are important sugarcane growing areas all of which have problems awaiting solution.

4. I, therefore, venture to put forward a scheme of research which would give rapid results during a period of five years to solve some of the problems mentioned above.

Nearly four-fifths of the irrigated area in the Presidency is under flow irrigation ; but the needs of the farmer engaged in lift irrigation, situated as he is under most adverse circumstances labouring hard at the *mhote* or *picotah* and irrigating but a few cents a day at high cost, have to be considered at the same time. It is, therefore, proposed to have two stations, a large one to represent flow irrigation and a smaller one for tracts under lift irrigation.

5. Improvement in the economics of the sugarcane cultivator may be effected either by increasing the yield or by reducing the cost of cultivation or by both. The problems to be investigated come under three distinct heads :—

1.—*Increase in the yield of sugarcane.*

- By (a) Varietal tests. These will be laid down in collaboration with the work that is being done with thick canes at the cane breeding station, Coimbatore.
- (b) Vigorous seed material obtained by short crop planting. A large measure of success has already been achieved in one or two varieties at the Agricultural Research Station, Anakapalle, but this needs augmentation and duplication in tracts different in climatic and soil conditions like the Chittoor district.
- (c) Spacing methods in relation to varieties and source of irrigation, methods in planting, cultural methods, etc.
- (d) Manurial methods. Sufficient information in the manuring of sugarcane has already been gained and therefore no investigation in this direction is proposed except in so far as it affects items 2 (a) and 3 (a) below.

2.—*Reduction in cost of production.*

- By (a) A reduction in the manure bill. The investigation aims at finding out the possibility of cutting down the cost of manuring the bulk crop by judiciously manuring the crop intended for seed material. Experiments in plant nutrition have revealed that plants absorb large quantities of nutrients in their very young stages and plants with a good start are better able to withstand adverse conditions in later life. Therefore, seedlings or seed material raised under well manured conditions should, according to this observation, do better after transplanting or sowing than those raised under unmanured or insufficiently manured conditions. Experiments carried out at Coimbatore and Anakapalle have already indicated that this is the case. Further experimental proof is necessary and if this is obtained, we should be giving a distinct stimulus to cane cultivation by considerably reducing the cost under manure.
- (b) A reduction in the cost of irrigation. During the growth of the crop, sugarcane receives a large number of irrigations ; in localities under lift irrigation, the area under sugarcane is mainly limited by the amount of irrigation water available. In seasons of deficient rainfall, the area becomes considerably reduced.

Experiments at the Agricultural Research Station, Anakapalle, have revealed that Co. 213 can be grown successfully under normal rainfall conditions supplemented by about 4 acre-inches of irrigation at the time of planting. If this experiment could be successfully repeated at this place with other varieties; and in localities where irrigation is costly, it will be little short of a revolution in the irrigational practices of the country. This would also tend to increase the area of sugarcane in the Presidency.

- (c) A reduction in the cost of methods in wrapping and propping. On account of cyclonic storms the Province is subject, the practice of wrapping and propping cane is almost universal, entailing a large amount of outlay. The methods employed are capable of improvement in efficiency and of reduction in cost. An investigation into the methods of planting and spacing may even result in the elimination of the operation.
- (d) A reduction in cost of cultural and planting methods. The indigenous practices are laborious, slow and wasteful. Introduction of labour saving machinery and more efficient methods in planting are indicated.

### 3.—*Improvement in the manufacture of jaggery.*

- By (a) An improvement in the colour and keeping qualities of jaggery. The loss to the cultivator consequent on defects in these, our ignorance of the chemistry of jaggery manufacture, and the fact that this aspect has so far remained unexplored by other workers made an investigation into this subject imperative. The enquiry will be to ascertain the factors that affect the colour and keeping quality of jaggery and the effect of manures on its quality. Although a beginning is being made in this investigation at the Agricultural Research Station, Anakapalle, for a thorough and a large scale investigation that this important problem warrants, the laboratory and equipment need immediate extension.
- (b) An improvement in the mechanical methods employed in the manufacture of jaggery and brown sugar. The manufacture of white sugar suited to ryots' conditions is in an undeveloped state practically throughout the country. With the collaboration of the Department of Industries, it is also proposed to explore the possibility of introducing centrifugal machines so largely employed in the United Provinces. As this aspect will be dealt with by the Director of Industries in detail, it is unnecessary for me to dilate on this further.

It will be observed that problems proposed to be tackled are in the main of inter-provincial importance and it is hoped that investigations proposed here will profit also the ryots of other Provinces.

6. Estimates herein attached are self-explanatory. The object being to make use of materials and resources available at Anakapalle, provision is made there only for bare necessities in equipment. The land proposed for the sub-station will be taken on lease. All buildings proposed for erection will be of a temporary nature, so that at the expiry of the lease they will be worth practically nothing. The experimental area of 50 acres at the Agricultural Research Station Anakapalle,

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and the 30 acres of the sub-station at Chittoor, will with a 3 year rotation give about 26 acres of cane, 20 acres of garden crops (two crops) and 35 acres of paddy. Since the Director of Industries is making adequate provision for his needs, the expenditure connected with his part of the scheme is omitted. Of the staff provided, the following are available at Anakapalle for this scheme :—

- 1 Superintendent,
- 2 Farm Managers,
- 1 Assistant Farm Manager,
- 1 Chemistry Assistant,
- 1 Laboratory Attender,
- 1 Fieldman, and
- 1 Peon.

The additional staff required is as follows :—

*Anakapalle.*

	Ra.
1 Farm Manager on .. .. .	120—10—170
1 Assistant in Botany on .. .	85—5—120
1 Fieldman on .. .. .	35—50

*Chittoor.*

	Ra.
1 Farm Manager on .. .. .	120—10—170
1 Farm Manager on .. .. .	85—5—120
1 Assistant in Botany .. .. .	85—5—120
2 Fieldmen on .. .. .	35—50
1 Clerk on .. .. .	60—4—80
1 Peon on .. .. .	12—18

7. The total expenditure of the scheme for 5 years comes to Rs. 2,56,900 of which the contribution of the Government of Madras is as follows :—

	Ra.
Staff .. .. .	56,000
Working Expenses .. .. .	50,800
Total ..	1,06,800

8. The following will be the annual receipts from the two stations :—

	Ra.
1. Jaggery from 26 acres at 8,000 lbs. per acre (208,000 lbs. at 15 lbs. per rupee) .. .. .	13,866
2. Paddy from 35 acres yielding 2,500 lbs. per acre. (87,500 lbs. at 45 lbs. per rupee) .. .. .	1,944
3. Garden produce from 40 acres at Rs. 100 per acre .. .. .	4,000
4. Cane setts, etc. .. .. .	40
Total ..	19,850



## Proposed Sugarcane Research Stations.

	Acres.
<i>Land required—</i>	
Sub-station at Chittoor under irrigated dry condition .. .. .	30
Space for buildings, sheds, furnace, etc. .. .. .	3
Total ..	33

*The lease value will be:—*

	Ra.
30 acres garden land at Rs. 75 an acre .. .. .	2,250
3 acres dry land at Rs. 16 per acre or roughly .. .. .	50
Total ..	2,300

*Lay out, road, fence, etc.—*

	Ra.
Lay out of plots at Chittoor .. .. .	600
Fencing with barbed wire, 5 strands with angle iron posts inclusive of iron posts, corner posts, gates—2,500 yards at Rupee one a yard .. .. .	2,500
Wire netting for 10 acres of sugarcane against jackal attack .. .. .	600
Total ..	3,700

*Buildings—Residential.—Katcha buildings to last for about 5—7 years.**At Chittoor—*

	Ra.
One Manager .. .. .	3,000
One Assistant Manager .. .. .	2,000
One fieldman .. .. .	1,000
Four cooly huts .. .. .	400
Total ..	6,400

*Non-residential—*

	Ra.
Office room and store 48' × 15' with 8' Verandah in front. Brick in mud with concrete flooring and galvanised iron roofing protected with matting for the office alone at Rs. 1-8-0 a sq. ft. ..	1,350
Cattle shed for 5 pairs with a feed-room, brick in mud walls, earth flooring and thatched shed 50' × 10', 500 sq. ft. at 0-12-0 a sq. ft.	375
Cart stand and implement shed (thatched) 25' × 15', 12' × 15', 540 sq. ft. at 0-12-0 per sq. foot .. .. .	405
Drying and threshing floors .. .. .	150
Furnaces and shed .. .. .	150
Water meters .. .. .	500
Water troughs, feed trough, etc. .. .. .	100
Rain gauge .. .. .	50
Anemometer and Thermohygrograph, etc. .. .. .	1,000
Miscellaneous .. .. .	120
Total ..	4,200
Total buildings for Chittoor .. .. .	10,600

Equipment.	Anakapalle. Chittoor	
	Rs.	Rs.
Live-stock 5 pairs at Rs. 350 each .. ..	..	1,750
Dead-stock—6 cane mills (2 for Anakapalle) .. ..	300	600
Jaggery pans, moulds, etc. .. ..	300	200
Bins, receptacles, etc. .. ..	..	200
Two oil engines .. ..	..	4,000
Chains, ropes, etc. .. ..	..	150
Field labels .. ..	..	30
Two carts .. ..	..	240
Farm tools, crow bars, etc. .. ..	..	150
Ploughs and field implements .. ..	..	200
Laboratory materials for chemical and botanical equip- ment .. ..	2,300	1,700
Thermohygraph and other meteorological instruments	1,000	..
Miscellaneous items like reference books, etc. .. ..	400	480
<b>Total ..</b>	<b>4,300</b>	<b>9,700</b>

*Furniture—Chittoor—*

	Rs.
Tables 4 .. ..	120
Chairs 6 .. ..	30
Almirahs 2 .. ..	70
Record racks, shelves, etc. .. ..	50
Clocks, coat-rack, wash stand .. ..	30
<b>Total ..</b>	<b>300</b>

*Staff.*

	Madras. I. C. A. R. contribu- Contribution. tion.	
	Anakapalle. Rs.	Chittoor. Rs.
Superintendents Rs. 250—25—750/(425) .. ..	5,100	..
2 Farm Managers Rs. 120—10—170/(140) .. ..	..	1,680
1 Farm Manager Rs. 85—5—120/(120) .. ..	1,440	..
1 Farm Manager Rs. 85—5—120/(120) .. ..	1,440	..
1 Farm Manager Rs. 85—5—120/(95) .. ..	..	1,140
1 Assistant Farm Manager Rs. 45—3—75/(73) .. ..	876	..
2 Botany Assistants Rs. 85—5—120(95) .. ..	..	1,140
1 Chemistry Assistant Rs. 85—5—120/(117) .. ..	1,404	..
1 Fieldman Rs. 35—50/(41) .. ..	492	..
3 Fieldmen Rs. 35—50/(38) .. ..	..	456
1 Clerk Rs. 60—4—80/(68) .. ..	..	816
1 Laboratory Attendant Rs. 25—1—35/(27) .. ..	324	..
2 Peons Rs. 12—18/(12) .. ..	144	144
<b>Total ..</b>	<b>11,220</b>	<b>5,832</b>
<b>or ..</b>	<b>11,200</b>	<b>or 5,800</b>
		<b>9,108 or 9,100</b>

ABSTRACT.

Particulars.	I year.			II year.			III year.			IV year.			V year.		
	Madras contribution Anaka-palle.	I. C. A. R. contribution.		Madras contribution Anaka-palle.	I. C. A. R. contribution.		Madras contribution Anaka-palle.	I. C. A. R. contribution.		Madras contribution Anaka-palle.	I. C. A. R. contribution.		Madras contribution Anaka-palle.	I. C. A. R. contribution.	
		Anaka-palle.	Chittoor.		Anaka-palle.	Chittoor.		Anaka-palle.	Chittoor.		Anaka-palle.	Chittoor.		Anaka-palle.	Chittoor.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1. Lay out .. ..	..	..	3,700	..	..	..	..	..	..	..	..	..	..	..	..
2. Buildings .. ..	..	..	10,600	..	..	..	..	..	..	..	..	..	..	..	..
3. Equipment .. ..	..	4,300	9,700	..	..	..	..	..	..	..	..	..	..	..	..
4. Furniture.. ..	..	..	300	..	..	..	..	..	..	..	..	..	..	..	..
5. Working Expenses ..	11,400	..	16,100	9,600	..	11,000	9,900	..	12,900	10,000	..	13,000	9,900	..	13,000
6. Staff .. ..	11,200	3,300	5,800	11,200	3,300	5,800	11,200	3,300	5,800	11,200	3,300	5,800	11,200	3,300	5,800
7. Travelling Allowance	..	1,500	..	..	1,500	..	..	1,500	..	..	1,500	..	..	1,500	1,500
8. Contingencies .. ..	..	500	..	..	500	..	..	500	..	..	500	..	..	500	..
	22,600	9,600	46,200	20,800	5,300	16,800	21,100	5,300	18,700	21,200	5,300	18,800	21,100	5,300	18,800
<b>Total .. ..</b>	<b>22,600</b>	<b>55,800</b>	<b>20,800</b>	<b>22,100</b>	<b>21,100</b>	<b>24,000</b>	<b>21,200</b>	<b>24,100</b>	<b>21,100</b>	<b>21,100</b>	<b>24,100</b>	<b>21,100</b>	<b>24,100</b>	<b>21,100</b>	<b>24,100</b>
<b>GRAND TOTAL ..</b>	<b>2,58,900</b>														

## ENCLOSURE II.

COPY OF A NOTE BY THE AGRICULTURAL EXPERT, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, DATED THE 19TH NOVEMBER 1931.

This scheme contains two proposals :—

- (1) for the provision of an experimental farm at Chittoor at a cost of Rs. 14,300 for land on lease and temporary buildings, Rs. 10,000 for equipment, Rs. 66,000 spread over 5 years for cultivation and other working expenses and Rs. 5,800 per annum average cost of staff. The total cost of this part of the scheme for 5 years is Rs. 1,17,800.
- (2) The other part of the scheme is for an expansion of the Anakapalle farm at a cost of Rs. 4,300 ~~non-recurring~~ for additional equipment, Rs. 5,300 per annum for additional staff including travelling allowances and contingencies, making a total cost of Rs. 30,800 for 5 years.

The abstract at the end of the statement shows that the Council is asked to provide a total of Rs. 1,50,100. As I understand the proposal, the sum of Rs. 1,06,800—the Madras Government contribution—does not represent any new money at all but only what they are spending on the Anakapalle farm at present.

2. In paragraph 8 of his letter, the Director of Agriculture estimates the receipts from the two stations at Rs. 19,850 per annum but neither he nor the Madras Government say anything about making these receipts available for the scheme, and we may be quite certain that the Madras Government will not surrender the receipts of the existing Anakapalle farm without claiming them as part of their contribution. As things stand, therefore, it seems to me that the Council is being asked for a contribution of Rs. 1,50,100 spread over 5 years and not for Rs. 50,850 only.

3. Turning now to the programme of work, there is nothing in paragraph 5 so far as I can see, which is not already being carried on at Anakapalle with the exception of the experiments in *gur* and sugar manufacture. It is therefore a little difficult to see why it is proposed to increase the number of Farm Managers at Anakapalle from 2 to 3, why a Botanical Assistant is needed at each farm since Coimbatore will do the breeding work and supply the canes for testing or why the Council should contribute Rs. 1,500 per annum for travelling allowance of the staff of the Anakapalle farm. I note that the Anakapalle farm has already a Chemical Assistant. I presume that the chemical testing of the canes grown at Chittoor can be arranged at the Central Laboratory at Coimbatore but this should be verified.

4. One of the main justifications of the proposal is the possibility that the new canal in the Coimbatore district will be used for the irrigation of sugarcane instead of paddy; the Committee are sure to enquire whether Chittoor is sufficiently near to Coimbatore and the land sufficiently similar to make it suitable. The existence of 10,000 acres of cane in Chittoor district is hardly a justification for a grant from Council.

## ENCLOSURE III.

COPY OF A DEMI-OFFICIAL LETTER FROM S. V. RAMAMURTY, Esq., I.C.S., SECRETARY TO THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT, TO SIE T. VIJAYARAGHAVACHARYA, K.B.E., VICE-CHAIRMAN, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, NO. 1342-III|31-9, DATED THE 2ND DECEMBER 1931.

*Scheme of Research on Sugarcane.*

With reference to your demi-official No. 2783-Agri., dated the 23rd November 1931, (not printed) I am to say that the contribution of Rs. 1,06,800 is the amount already spent by the Local Government on the Anakapalle Farm in the same way as the Bombay Government's contribution to its sugarcane station in the Bombay-Deccan approved by the Governing Body in May 1931, was the cost of the Manjri Experimental Farm already maintained by them. Of the anticipated receipts of Rs. 19,850 from the stations, the receipts from sugarcane and its products amounting to Rs. 13,906 would be available for the scheme.

2. A copy of the note of the Director of Agriculture, Madras, on the points raised by Mr. Burt is enclosed.

COPY OF NOTE OF THE DIRECTOR OF AGRICULTURE, MADRAS, DATED THE 1ST DECEMBER 1931.

*Paragraph 3 (a).*—Although the main lines of research indicated in the programme are already being carried out in some measure at Anakapalle this work is going to be done much more intensively; besides, very little attention has been paid to items 1 (c), 2 (d) and 3 (a) and (b). As indicated in paragraph 3 of my letter, research is carried on in paddy and ragi besides sugarcane, not to mention the research work recently started on citrus fruit. At present the hands of the Superintendent are fully occupied. When the scheme is sanctioned, not only will his hands be fuller in view of the more intensive nature of research in sugarcane, he will be in additional charge of the experimental work at Chittoor. The Superintendent will then have to pay periodical visits to Chittoor. There is, therefore, a case for an understudy to the Superintendent who would relieve him while at headquarters in certain items of work connected with the station and also look after the station during the absence of the Superintendent at Chittoor. Therefore, a senior Farm Manager has been proposed. The other two Farm Managers on a lower grade are already fully occupied in carrying out the various items of research in progress and cannot relieve the Superintendent.

(b) In regard to the provision for a Botanical Assistant at Anakapalle, I might say for want of requisite staff, no detailed botanical study of the various varieties under trial has been attempted there. Botanical study on the spot is also essential for discovering types of canes which would withstand cyclonic storms on the one hand, and drought on the other. These studies at Coimbatore cannot help Anakapalle.

(c) The travelling allowance provided for is for the Superintendent and the Chemical Assistant, the former to pay periodical visits to Chittoor because he is in charge of the station and the latter for chemical analysis. It is very desirable that the same Chemist looks after work at both the places as he will be in a position to compare the effect of similar treatments under dissimilar conditions of climate, soil and irrigation prevailing at Chittoor. The Chemical Assistant already at work at Anakapalle will also look after Chittoor, and I prefer this arrangement to getting it done from Coimbatore.

*Paragraph 4.*—Chittoor is a night's journey from Coimbatore, but the chief reason for selecting Chittoor as a sub-station is as explained above, that conditions are entirely dissimilar here to those at Anakapalle. The Chittoor ryot works under different conditions. I have attempted to explain this in paragraph 4 of the scheme. Besides, Chittoor is the only district in the Presidency where sugar manufacture under indigenous method is being attempted ; it is, therefore, imperative that our experiments must be carried out here. For the same reason, the Director of Industries, I presume, is desirous of getting his investigations done at Chittoor.

ENCLOSURE IV.

EXTRACT FROM PROCEEDINGS OF THE 4TH MEETING OF THE SUGAR COMMITTEE HELD  
AT NEW DELHI, ON TUESDAY, THE 8TH DECEMBER 1931.

• • • • •

Mr. Burt read the report of the Sub-Committee appointed yesterday to consider the various provincial schemes. The report was adopted.

REPORT.

(3) *Madras Agricultural scheme.*

The Sub-Committee felt that they had not sufficient information before them to come to a definite conclusion on the financial details presented. They are agreed that the Anakapalle sugarcane research station should be strengthened. They also agree to the principle that a sub-station should be established on one of the new canal areas but they would like the suitability of Chittoor for this purpose to be further examined.

• • • • •

In connection with this report Chowdhry Mukhtar Singh enquired if there was any co-ordination between the research schemes of the various provinces to which Mr. Burt replied that these schemes were the result of our previous decision to have a chain of research stations in the main sugarcane belt.

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As regards Madras, Mr. Burt explained that the Madras Government had now revised their former opinion that there was no scope for the expansion of sugarcane cultivation in that Presidency and the present proposal of the Madras Government was based on that view. The Sub-Committee approved of the expansion of the Anakapalle research station and of the provision of a sub-station but desired the question of site of the latter to be more fully examined. The scheme was complete on the financial side but lacking in technical details.

## APPENDIX XVII

SUBJECT No. 18.

SUGARCANE INSECT PESTS (INCLUDING THE CARRIERS OF MOSAIC)  
SCHEME FOR WORK AT PUSA.

At their fourth meeting held in December 1931 the Sugar Committee considered the Sugarcane Insect Pests (including the carriers of Mosaic) scheme (Enclosure I) for work at Pusa ; but the sense of the meeting was that the expenditure proposed should not be incurred (Enclosure VII).

The subject is now submitted for the consideration of the Advisory Board.

T. VIJAYARAGHAVACHARYA,

Secretary.

8th January 1932.

## ENCLOSURE I.

NOTE FOR THE SUGAR COMMITTEE, 4TH MEETING, HELD IN DECEMBER 1931.  
*Sugarcane Insect Pests (including the carriers of Mosaic) scheme for work at Pusa.*

In connection with the above scheme attention is invited to the following papers :—

- (1) Note (Enclosure II) by Mr. Hydari, for the second meeting of the Sugar Committee held in January 1930, and its enclosures.
- (2) Extract (Enclosure III) from the Proceedings of the 2nd meeting of the Sugar Committee, held at New Delhi in January 1930.
- (3) Extract (Enclosure IV) from the Proceedings of the meeting of the Advisory Board of the Imperial Council of Agricultural Research, held at Simla in June 1930.

The papers Nos. (2) and (3) above were placed before the Sugar Committee at its last meeting held in August 1930, but the Committee only noted the discussions at the Advisory Board (Enclosure IV).

2. Mr. Fletcher, who has now resumed his duties after the expiry of his leave, was requested to revise his scheme in the light of the remarks made by the Sugar Committee and the Advisory Board (Enclosures III and IV). In reply he has sent in a Note (Enclosure V) stating that he does not consider that any essential alterations are desirable.

The Scheme is now resubmitted for the consideration of the Sugar Committee.

T. VIJAYARAGHAVACHARYA,

Secretary.

NEW DELHI,

The 10th November 1931.

## ENCLOSURE II.

NOTE FOR THE MEMBERS OF THE SUGAR COMMITTEE (ITEM 8 OF AGENDA).  
*Sugarcane insect pests (including the carriers of Mosaic) Scheme for work at Pusa.*

The Sugar Committee considered (Annexure I) this scheme at their last meeting but deferred its detailed examination until their next meeting.

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2. A copy of the scheme as submitted by the Imperial Entomologist, Pusa, is attached (Annexure II). It will be observed that on the basis of the figures given for 1930-31 the scheme involves a permanent recurring expenditure of Rs. 23,260 plus £360 or Rs. 28,060 per annum on account of the necessary staff, touring charges, apparatus and experiments and contingencies and a non-recurring expenditure of Rs. 30,616 for buildings and apparatus.

3. In this connection it may be mentioned that the following general principles for regulating the making of grants by the Council have recently been suggested (since approved) for the consideration of the Governing Body of the Imperial Council of Agricultural Research :—

- (i) That the scheme should be of all-India importance or in other words that the problem which it sets out to solve is one which affects more than one province.
- (ii) That where a scheme is suggested for one province the possibility of co-operating with adjoining provinces in its prosecution should be explored.
- (iii) That, ordinarily, land and buildings required under a scheme should be provided by the local Government or Governments concerned, the Council making a grant for equipment and staff alone.
- (iv) That all assistance should ordinarily be limited in the first instance to five years and should not involve the Council in any pension or other permanent liability.
- (v) That the expenditure proposed should not be in relief of normal provincial expenditure.
- (vi) That, ordinarily, the expenditure on a scheme submitted by a Provincial Government should be apportioned as between the Council and the Government concerned on a fifty-fifty basis.
- (vii) That a scheme other than one submitted by a local Government should have the support of the Government of the Province from which it emanates.

The principles mentioned above have not yet been approved (since approved) by the Governing Body but the Committee may, when examining the present scheme, consider such of them as are applicable to this case.

4. In any event, the Imperial Council of Agricultural Research cannot sanction any permanent appointments as proposed in the scheme or assume any responsibility for pension or other permanent liability. Any grants to be sanctioned by it must therefore be limited to a period of years, say 5, in the first instance. Similarly, the buildings proposed in the scheme will form a permanent addition to the Pusa Estate and as such their cost can hardly be charged to the Council.

5. The Agricultural Expert Adviser to the Council also considers certain alterations necessary in the details of the scheme in order to place it on a five-year basis; and a copy of the statement of details as revised by him is attached (Annexure III) for the consideration of the Committee. The revised scheme involves an average recurring expenditure of Rs. 38,500 per annum and a non-recurring expenditure of Rs. 5,000, or a total liability for 5 years of Rs. 1,97,500.

M. S. A. HYDARI,

Secretary.



## ANNEXURE I

EXTRACT FROM THE INTERIM REPORT OF THE SUGAR COMMITTEE APPOINTED BY THE  
IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

17. We have also considered proposals for a chain of sugarcane experiment stations in Tirhut, Gorakhpur, Meerut, the Punjab and the Bombay-Deccan; for physiological research on cane at Meerut, for work on sugarcane diseases at Pusa and in Gorakhpur (United Provinces), for research on sugarcane pests at Pusa, for a grant-in-aid to the Harcourt Butler Technological Institute, Cawnpore (for research work in sugar technology), and for post-graduate scholarships for the study of sugarcane agriculture and sugar technology. For many of these projects detailed proposals have not yet been put forward by the Governments concerned but the provincial representatives present have promised them. We have therefore deferred their examination until our next meeting.

## ANNEXURE II

*Scheme for providing a separate entomological staff for dealing with work on sugarcane pests.*

Numerous insects attack sugarcane in India and include Termites, Crickets, Beetles, Borers, Leaf-eating Caterpillars, Grasshoppers, and various Sucking insects. Of these the Borers are the most important from an economic viewpoint. A good deal of work done on Borers (as well as other Cane Pests) at Pusa, has shown that these insects do not belong to a single species, as was supposed formerly, but include many different species—about a score have been discriminated and doubtless many remain to be discovered—which differ in habits (life-histories, food-preferences, etc.) and times and areas of occurrence. A very complete investigation of the natural history, in the widest sense of this word, of each different species is required before we shall be in a satisfactory position to advise control measures. This work demands a whole-time staff to take it up and it should not be done in an isolated manner because it will require the fullest collaboration with other entomological workers. For example, some cane-borers attack other cereal crops (maize, rice, etc.), whilst biological control will require full knowledge of predators and parasites of Cane Insects, which needs extensive knowledge of the habits and bionomics of such predators and parasites as regards their relations with insects other than cane pests. For these reasons I consider that any staff for work on Cane Insects would best be attached to Pusa, as Pusa is (at present, anyway) in the best position to give the necessary assistance.

As regards staff I consider the following should be the minimum to start with:—

- One Sugarcane Entomologist,
- One Senior Assistant Entomologist,
- One Junior Entomological Assistant,
- One Chaprasi.

The selection of a really first-class man for the post of Sugarcane Entomologist is the most essential part of the whole problem. The work done already at Pusa has served to show that the problems, even as regards Borers only, are very complex and will require prolonged study to attain any adequate knowledge of the various species which occur in sugarcane in India, and that, if any ultimate benefit is to result in the way of applied knowledge as regards control, a merely

temporary post will be of comparatively little value to India. To accomplish any real good, I consider that a permanent *ad hoc* staff is required and that such will prove its worth, provided that a really suitable man is obtainable. If an Entomologist is taken on a temporary basis, no short-term agreement will provide sufficient time for an adequate preliminary survey whilst the incumbent will probably leave at the end of his term to take a post with one of the numerous Sugar Companies, or if his term is extended, it will only be at rates which will ultimately be less economical than if he had been given a permanent post in the first place.

Practical work in cane-fields throughout the year is very exhausting physically and any acceptable candidate should therefore have an exceptional constitution as well as the best professional qualifications. At present the demand for Entomologists throughout the world is much in excess of the supply and in any case it will not be easy to secure a suitable man. To secure and retain a really suitable man—and only the best will repay the cost—good terms must be offered and I would suggest a minimum rate of Rs. 1,000 per mensem (inclusive of any Overseas Pay and Pusa Allowance) in the ordinary pensionable scale of the Indian Agricultural Service (or its equivalent if non-pensionable) but with Provident Fund contribution. If a short-term agreement is decided on, higher rates will be necessary.

For the two Assistants and Chaprasi, the ordinary rates of the Agricultural Service should suffice, but I would note that a starting pay of Rs. 100 is not really enough to secure really good men in Assistants' posts.

A Senior Assistant will be required to work with the Entomologist and to carry on work at Headquarters temporarily when the Entomologist is on tour. A Junior Assistant will be required principally for field work. A Chaprasi will be required for any touring.

If the Cane Entomologist has his Headquarters at Pusa, other assistance required (Fieldmen, Artists, Labour, Clerical assistance) can be provided by my Section to start with. Similarly, Insectary and Laboratory accommodation can be provided to start with.

Should the development of the cane work necessitate expansion, proposals can be sent up as necessary. I assume that any small areas for field experiments can be provided at Pusa without extra expense.

As regards house accommodation at Pusa, a permanent man will require to have a bungalow provided. In any case, he would presumably be appointed on three years' probation, during which time the present accommodation (available in the Supernumeraries' bungalow) might suffice. The case for the Cane Entomologist's Bungalow, therefore, is not urgent. But there is no available accommodation in the Pusa Estate for the extra Assistants and Chaprasi and quarters will have to be provided for these men before they can be appointed.

In addition to pay of the staff, some recurring expenditure will be required for :—

- (a) *Touring*.—Cane areas will have to be visited both in the vicinity of Pusa and in all cane-growing areas in India and Burma. In the first year, work will presumably be centred at Pusa and more extensive tours can be taken in the second and subsequent years.
- (b) *Apparatus and Experiments*.—No detailed estimate is possible, but my present budget will not meet any expansion in requirements and a small addition will be necessary.

Provision should also be made for non-recurring expenditure to provide necessary apparatus (microscopes, collecting apparatus, etc.) for the Cane Staff. The cost involved may be roughly estimated as under :—

		Budget Estimate, 1930-31.
		Rs.
Recurring :—		
Pay of Entomologist, if on a permanent basis Rs. 850 + 150 = Rs. 1,000 per month for first year (rising annually by Rs. 50 per mensem) plus £30 (O. S. P. if permissible) .. .. .		12,000
Leave Salary, cost of passage, Pension or Provident Fund contribution .. .. .		£ 360
Pay of Senior Assistant at Rs. 400 rising annually by Rs. 20 per mensem to Rs. 800 .. .. .		4,800
Pay of junior Assistant at Rs. 100 rising annually by Rs. 10 per mensem to Rs. 300 .. .. .		1,200
Pay of Chaprasi at Rs. 12 plus Allowance (say) .. .. .		200
Touring charges (for first year) .. .. .		2,000
Apparatus and Experiments .. .. .		2,000
Contingencies .. .. .		1,000
Total recurring .. .. .		23,200
		plus £ 360
Non-recurring :—		
Quarters for Senior Assistant .. .. .		14,000
Quarters for Junior Assistant .. .. .		7,000
Quarter for Chaprasi .. .. .		1,000
Apparatus .. .. .		2,000
Bungalow for Entomologist (Half the cost of converting No. 5 into two flats—One for the Cane Entomologist and the other for the Cane Mycologist .. .. .		6,616
Total non-recurring .. .. .		30,616

T. B. FLETCHER,  
*Imperial Entomologist.*

PUSA,  
The 3rd April 1929.

## ANNEXURE III.

## GRANT REQUIRED FROM THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

*Sugarcane Entomologist.*

	Average per annum (5-year basis).
Recurring expenditure :—	
	Rs.
Salary Entomologist (Rs. 1,250—50—1,450 + £30) ..	21,000
Salary Assistant Entomologist (Rs. 500—25—600) ..	6,600
Salary Junior Assistant (Rs. 200—15—260) ..	2,760
Chaprasi .. .. .	144
Travelling allowances .. .. .	2,300
Provident Fund at 1 12th pay .. .. .	2,542
Apparatus and Contingencies and casual labour ..	3,000
	<hr/>
Total ..	38,346
	<hr/>
	Say Rs. 38,500 per annum.
Non-recurring expenditure :—	
Apparatus .. .. .	2,000
(Return) passage and Travelling Allowance of officers to join appointment .. .. .	3,000
Total expenditure in 5 years ..	1,97,500
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## ENCLOSURE III.

EXTRACT FROM THE PROCEEDINGS OF THE SECOND MEETING OF THE SUGAR COMMITTEE, HELD AT NEW DELHI IN JANUARY 1930.

3. *Sugarcane insect pests (including the carriers of Mosaic) scheme for work at Pusa.*—Dr. McRae, in explaining the proposal, stated that though the grant applied for was only for 5 years, Mr. Fletcher did not expect that the work would be completed in that time: he was of opinion that justice would not be done to his scheme unless it was continued after the period of 5 years on a permanent basis. Dr. McRae quite realised that the Council could not bind itself to a permanent grant but he merely mentioned this for future reference.

Khan Bahadur Fateh-ud-Din invited reference to the note (not printed) he had submitted on this scheme and proposed that the scheme now before the Committee be circulated amongst Local Governments and their opinion regarding the help they were prepared to offer and the assistance they desired to seek be obtained. He was against centralising entomological work on cane pests at Pusa; work of this nature was being conducted in nearly all provinces and the proper

way, in his opinion, would be to give assistance to the provinces to expand their work in this direction. Mr. Clarke said that no work was being done on sugarcane entomology in the United Provinces as their Entomologist was more than fully occupied on the Pink Boll Worm scheme and locust control.

Chowdhry Mukhtar Singh was of opinion that there was little use in having a Research Institute at Pusa if for every item of research work the Institute wanted extra staff. In his opinion it would be far better if Pusa concentrated on one particular disease or pest rather than dissipate its energies on inconclusive investigations into many diseases. He said that there was no particular disease or pest which had so far been eliminated as a result of the research carried out at Pusa. Mr. Burt replied that Chowdhry Mukhtar Singh had not correctly appreciated the situation. The work which the Entomological Section at Pusa did was to tackle the systematic side of agricultural entomology for all crops and all insects; this was to identify insects, study life histories and furnish information to Provincial workers; with the present staff it could not undertake economic work. The work was two-fold, namely, systematic and economic; there was no other institution in India which was doing general systematic work in agricultural entomology and Provincial Institutions looked to Pusa to supply this. The problem now before the Committee was whether they could give any assistance in securing that adequate work on the economic side was performed; what was needed was an economic Entomologist somewhere for sugarcane pests. In the course of 20 years a good deal of information on cane pests had been gathered and it was quite true that an insufficient amount of work was being done on the economic side, Mr. Henderson was inclined to agree with Khan Bahadur Fateh-ud-Din that the staff proposed was inadequate and that steps should be taken to arrange for the co-ordination of sugarcane pests work now being done in different Provinces and to give assistance to the latter. Dr. McRae said that Mr. Fletcher was in close touch with the work being done in the provinces but that he would doubtless agree to a larger scheme which co-ordinated the work being done on cane pests all over India, and that it should be remembered that he had submitted the scheme keeping in mind the possible financial limitations.

Chowdhry Mukhtar Singh enquired whether the work could not be entrusted to Universities. Mr. Clarke considered that much could probably be done if suitable research schemes in sugarcane entomology were undertaken with the help of grants from the Council in the various Indian Universities; for example, the 5 Universities in the United Provinces had some very good Entomologists. The Chairman wondered whether further discussion should not be postponed till the Imperial Entomologist had been summoned and had explained his proposals to the Committee. Mr. Burt stated that Universities would want to know the specific problems which the Council wanted to be attacked; he suggested that a reference to Universities should be held up till the Imperial Entomologist had discussed matters with the Committee.

After discussion the Committee agreed that the proposals of the Imperial Entomologist now before the Committee should be circulated to Provincial Governments with a view to Provincial Departments of Agriculture and Universities through Provincial Research Committees being apprised of them; it should be ascertained how far Provincial Departments of Agriculture and Universities could co-operate in economic research on insect pests of cane; Provinces should also be asked to furnish statements of what technical assistance they needed and what they were prepared to supply themselves.

The Committee recommended also that the Imperial Entomologist should be asked to attend a meeting of the Committee.

## ENCLOSURE IV.

EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, HELD AT SIMLA ON THE 9TH JUNE 1930.

7. *Proceedings of the second meeting of the Sugar Committee held in January 1930.*—The proceedings of the second meeting of the Sugar Committee held in January 1930 were chiefly for the information of the Advisory Board as action thereon, in so far as the Board was concerned, had already been taken by circulation. There was, however, one particular on which the views of the Board were required and to this Mr. Burt drew attention by a reference to the printed proceedings of the meeting of the Committee. Members of the Board he said might be able to give information as to how far Provincial Departments of Agriculture and Universities could co-operate in economic research on the insect pests of cane. Further consideration of the scheme for work at Pusa on sugarcane insect pests had been deferred till the return of Mr. Fletcher from leave but it was thought that, in the meantime, information on the point mentioned above might be obtained. Mr. Afzal Husain, who was present at the meeting as a visitor, on being asked his opinion, stated that almost all Universities in India could take up small scale research on entomological problems in connection with sugarcane but not on actual control methods. At Pusa, work had so far been done only on the life history of individual pests. Messrs. Gangulee, Hilson and Allan said that the Calcutta, Madras and Nagpur Universities, respectively had not, at least so far as they knew, developed their entomological side and much assistance could probably not be obtained from them. Mr. Burt said that three points were clear :—

- (1) That a good deal of work on the life history of the insects pests of sugarcane had been done at Pusa,
- (2) That the bionomical side of the work could probably be remitted to Universities, and
- (3) That for the devising of control measures recourse would have to be had to Pusa and the Provincial Departments of Agriculture.

In regard to (3), the question was how much was to be done at Pusa and how much by the provinces. Mr. Finlow suggested that observations in the provinces could be made by trained entomologists appointed with the aid perhaps of grants from the Imperial Council which would be reported to and collated by a Central Entomologist at Pusa. Mr. Afzal Husain stated that he had already worked out a scheme in regard to research on sugar borers in the Punjab which would probably come before the Sugar Committee's meeting in August. This was in reply to a question by Mr. Burt whether there was any possibility of work being done in the provinces on the vectors of Mosaic.

At the instance of the Chairman, it was agreed that a record of the discussion should be communicated to the Sugar Committee at its next meeting.

## ENCLOSURE V.

*Copy of a Note by Mr. T. B. Fletcher, Imperial Entomologist, dated 13th October 1931.*

I have considered this matter in the light of the remarks made by the Sugar Committee and the Advisory Board and do not think that any essential alterations

are desirable. There may be small alterations in detail in the estimates, but I am of opinion that, if any satisfactory results are to be attained, some more or less permanent *ad hoc* staff is required to devote whole-time attention to this investigation, which is of the first importance to the cane industry in India.

This matter was laid before the Indian Sugar Committee which made a definite recommendation some ten years ago and this was endorsed by a Resolution of the Board of Agriculture in 1924.

The main requisite is to get a first-class Entomologist to devote his whole time to work in *cane fields* and the crux of the difficulty is to get a really suitable man. He must be in the closest touch with any other workers who can help him as far as possible in such details as preservation and identification of his specimens, both to save his time and for financial economy, and for these reasons also he should be stationed at a place where there are facilities for rearing insects, an entomological library, etc. It is for such reasons that I have advocated that this Sugarcane Staff should be added to the Entomological Section at Pusa.

Whilst some of the Provincial and University staffs may be in a position to carry out small local investigations on Cane Insects, I doubt whether these would carry us very far in the main problem of control of the major pests, and a number of small grants for such purposes would be likely to use up a comparatively large sum of money which would be expended to more advantage on a more centralized scheme. Decentralization is usually inefficient and wasteful when applied to scientific research work and it must be emphasized that it is research work in the field that is required as a prerequisite to the trial or recommendation of control measures.

My scheme (Annexure II to Enclosure II), as already submitted, was not based on hasty ideas but represents what I consider to be the minimum that should be done to try to check the present enormous losses of the national wealth of India by Cane Borers and other Cane Pests.

#### ENCLOSURE VI.

#### IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

#### SUBJECT No. 14.

#### SUMMARY OF INFORMATION COLLECTED ON THE SUGARCANE PEST "PYRILLA".

In December 1930, Chaudhri Mukhtar Singh drew the attention of the Research Council (Annexure I) to the damage which *Pyrilla* was causing to sugarcane in Meerut District. There have been various references to the damage done by this pest in the south-east Punjab also, and his reports show that the Imperial Sugarcane Expert took cognisance of this problem at least some three years ago in connection with breeding of cane varieties for this part of India; there is reason to believe that narrow-leaved and harsh-leaved varieties are less susceptible to attack than broad and soft leaved varieties. This pest has been under observation at Pusa for a number of years and a good deal of fundamental information is available there in regard to the life history of the pest. It does not appear to have reached the same importance in the south-east of the Northern India sugarcane belt as in the neighbourhood of Meerut. A note (Annexure II) by the Imperial Entomologist dated 5th January 1931 is enclosed.

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2. A reference was made to Mr. Clarke, Director of Agriculture in the United Provinces in December 1930 who replied as follows :—

“The question of the susceptibility of Co. canes to various diseases and insect pests is causing me a good deal of anxiety. While the local department can deal with immediate local remedial measures, it is surely the function of the Imperial Department to take up a question of such obvious all-India importance and to suggest suitable treatment.”

3. The Entomologist to the Government of the Punjab, though, by this time very busily occupied with his work as Locust Research Entomologist, kindly gave us some valuable data in regard to the degree of parasitization of this pest in that province and showed that it is much less parasitized there than Pusa. The attached note (Annexure III) has recently been received from the Government Entomologist, United Provinces.

4. No special reports of special damage to sugarcane by *Pyrrilla* have been received during the present season. In view of existing knowledge on this pest, time would seem to be ripe for direct economic investigation in control measures. Copy of Chaudhri Mukhtar Singh's letter dated 17th December is attached (Annexure I).

With regard to the concluding sentence, it is clear from Mr. Richards' letter (Annexure III) that no special work on *Pyrrilla* is at present in progress in the United Provinces; the scheme for work on sugarcane borers in the Punjab referred to by Mr. Afzal Hussain (Enclosure IV) has not yet come before the Council.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

*The 1st December 1931.*

#### ANNEXURE I.

COPY OF A DEMI-OFFICIAL LETTER FROM CHAUDHRI MUKHTAR SINGH, POONA, TO M. S. A. HYDARI, ESQ., I.C.S., SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, DATED THE 17TH DECEMBER 1930.

I think it very much better if you place the matter before the Sugar Committee and also get in the meantime the opinions of both Entomologists of Punjab and U. P. I feel if we really require to investigate the question of this pest, some man should be put exclusively on this work. It does not matter whether the gentleman belongs to Local Government or to Pusa. Personally I feel there are better chances of success if some Imperial man is placed on this work. If I remember aright, some work was done long before on this pest at Pusa and there may be some record of it there. If it is so, the same gentleman can easily be placed on this special work. If both the Local Governments take up the work separately, there would be want of co-ordination and waste of energy. As the activities of this pest are not confined to sugarcane alone, but it is affecting other crops also, I feel it desirable that the work may be undertaken as soon as possible. Will there be any harm if you be pleased to address a letter on this point to the Entomologists in both these provinces and find out as to what do they propose doing? If they have started some work, certainly it would be much better that we may help them in the grant.



## ANNEXURE II

NOTE BY THE IMPERIAL ENTOMOLOGIST, PUSA, DATED 5TH JANUARY 1931.

Direct control of *Pyrilla* is not easy because it occurs in large numbers, as a rule, only during the part of the cane season (July to October) when the cane has attained practically full growth and therefore such measures as bagging or spraying are impracticable on a field scale.

The egg masses, however, are quite conspicuous and may be collected in large numbers.

2. *Pyrilla* is usually parasitized very considerably. The rate of parasitization at Pusa this year has varied from 70 to over 90 per cent. If the rate of parasitization in affected areas is found to be low, it should help matters to introduce parasites from other areas or districts.

3. The only other direct method that I can suggest is the dusting of the crop with Calcium cyanide, which would probably have to be applied by aeroplanes. This would be expensive and difficult and could not be done in the vicinity of any dwellings, watchmen or domestic animals without risk of casualties. The cost of application in India would also be likely to exceed value of the crop saved and the difficulty of dealing with fragmentary holdings is obvious.

4. The practical control measures in India, therefore, seem to be (i) collection of egg masses and (ii) introduction of parasites. The former can be done by the people concerned in cane-growing; the latter requires expert assistance.

## ANNEXURE III.

COPY OF A DEMI-OFFICIAL LETTER FROM P. B. RICHARDS, Esq., ENTOMOLOGIST TO THE GOVERNMENT OF THE UNITED PROVINCES, CAWNPORE, TO DIWAN BAHADUR SIR T. VIJAYARAGHAVACHARYA, K.B.E., VICE-CHAIRMAN, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 1313|E.|4|31, DATED THE 20TH NOVEMBER 1931.

I regret that I have not been able to obtain any useful information about the attack of *Pyrilla* on sugarcane in the Meerut Division last year. I was on leave at the time, and, so far as I can find, no information was sent to my Section about the attack.

Sporadic attacks of *Pyrilla*, more or less severe, occur on the crop in the United Provinces and a few specimens may always be found in any cane field. Severe attacks have usually been either on young cane, or in unthrifty crops suffering under bad cultivation or fungus diseases. From what I have gathered, the latter may have stimulated the increased incidence of *Pyrilla* in the Meerut Division but the cause and effect may conceivably be reversed. I have not, personally, observed a serious attack on healthy, well-grown fields.

Contributing factors to attack on young cane appear to be late harvesting, in which case the pest moves directly from the old to the young canes; and ratooning.

The effect of *Pyrilla* attack upon sugar yield per acre was not considered to be serious by Clarke, but I know of no comparative data. The pest is considered to be of greater importance as a vector of mosaic than in its direct action; but as mosaic is readily controlled by the selection of mosaic-free plants for seed, the question of *Pyrilla* control on this account has not been considered urgent.

No investigation of *Pyrilla* has, therefore, been carried out, and, except for observations on minor outbreaks on the College farm here, I have no data upon parasitisation.

I regret I have no more useful information to offer. I should welcome an investigation which would elucidate the economic status of the pest, and explore cultural, biological and direct methods of control ; and should be glad to afford such assistance in obtaining data or providing facilities for work as the resources of the Entomological Section permit, subject to the acquiescence of the United Provinces Government.

#### ENCLOSURE VII.

##### EXTRACT FROM THE PROCEEDINGS OF THE FOURTH MEETING OF THE SUGAR COMMITTEE.

In the absence of Mr. Fletcher, Dr. McRae explained the desirability of carrying on investigations into the pests of sugarcane on an all-India basis at Pusa, where they had facilities in the matter of Library, apparatus, etc., etc. He said that great damage was being done to sugarcane by borers, etc., and last year *Pyrilla* had caused a very serious damage to this crop. He stated that *Pyrilla* was not so serious in Bihar where there was a Parasite attacking it but evidently this Parasite was not existing elsewhere. There was therefore need to look into the causes of such happenings. He added that in view of the impending reductions in the Pusa staff the scheme would have to be supplemented by the addition of a little more staff. Mr. Mehta said that the results of entomological research so far available are not practicable as they are not applicable on a field scale. The only advice which he said is generally given in such cases is that nothing can be done on account of prohibitive expenditure. He was therefore of opinion that we should concentrate on getting disease-resisting varieties rather than ask for the luxury of working out the life histories of insects. Mr. Burt was of opinion that that would be putting too much work on the shoulders of the breeder to depend entirely on these for varieties resistant to all possible diseases and pests. He drew attention to the information compiled about *Pyrilla*. Chowdhry Mukhtar Singh said that Pusa has never finished any research in such cases and has generally gone on to another scheme leaving the one in hand unfinished. He said that Pusa is a research institution but every time a problem comes up they ask for fresh grants. Mr. Mehta again emphasized his point and said that control measures regarding insect pests were not practical politics. Mr. Burt said that he disagreed. In the case of *Pyrilla* for example there was every possibility of biological control. Khan Bahadur Fateh-ud-Din said that every Provincial Department has now well equipped entomological section and the Provincial Departments should be co-ordinated for this work by assistance where necessary. Mr. Das said that every cane investigation station everywhere in the world had an entomologist and whenever a pest appeared he was ready to fight it. Rather than having scattered schemes in Provinces, he was of opinion that the Imperial Council of Agricultural Research should have its own research station for all aspects of sugarcane research. Rao Bahadur Venkataraman said that biological control was the only successful remedy in such cases but not easy of application over large areas, nor were methods of control like spraying, etc. His viewpoint was that as is being done all the world over we should aim at producing disease resistant varieties and the problem of producing such varieties was not very difficult. Even now there were varieties like Co. 205, 285, 244 and 300 which had resisted the attack of *Pyrilla*. He said it would be very difficult with a frequent change in varieties almost every year to work out control measures regarding the pests particular to any single variety. He was therefore of opinion that in these days of financial stringency the easiest way of fighting disease was by a change of variety. The Chairman in summing up said that the sense of the meeting appeared to be that the expenditure proposed should not be incurred.

## APPENDIX XVIII

SUBJECT No. 19.

## REPORT OF THE LOCUST COMMITTEE—PROPOSALS FOR FUTURE RESEARCH.

Attention is invited to the attached note (Enclosure I), circulated to the members of the Locust Committee in connection with the meeting held on the 18th and 19th January 1932. This explains in brief the scheme for research of the life history of the desert locust sanctioned by the Council and progress made so far in the scheme. It will be seen from its proceedings that the Locust Committee has recommended the extension of the research scheme for a further period of one year from April 1932 in its present form.

2. The financial position of the scheme upto the end of March 1932 is explained in Enclosure III. It is estimated that a sum of Rs. 1,27,000 will be spent for 15 months against a grant of Rs. 1,76,000 sanctioned by the Governing Body. The estimated cost for the extended period will be Rs. 1,11,220 (Enclosure IV), and thus an additional sum of Rs. 62,220 will be required for this scheme.

The recommendation of the Locust Committee is now for the consideration of the Advisory Board.

M. S. A. HYDARI,

*Secretary.**The 26th January 1932.*

## ENCLOSURE I

## IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, LOCUST COMMITTEE, THIRD MEETING, JANUARY 1932.

*Locust Research Scheme—a brief review of its progress.*

The Locust Committee of the Imperial Council of Agricultural Research at its second meeting held in May 1930 recommended *inter alia* that research should be undertaken on the life history of the desert locust in India so as to obtain as accurate and thorough a knowledge of this insect as would help the devising of proper methods for its control and that a special staff should be employed under the Council for this purpose. The Committee was of the opinion that locust research in India should be divided into two sections one dealing with those tracts liable to be affected by locusts which were in the plains—the plains group—comprising mainly the United Provinces, the Punjab and the North-West Frontier Province and the other for the desert area or the desert group comprising Baluchistan, Rajputana and Sind. The Committee considered that for the first group efforts should be made to secure the services of Mr. M. Afzal Husain, as the Entomologist in charge and for the second a scientist of considerable experience of locust investigation and control methods. As agreed to by the Committee, Mr. Afzal Husain drew up a scheme (Not Printed) of research on the above lines which was submitted to the Advisory Board for consideration. The Advisory Board commended the proposals to the favourable consideration of the Governing Body. The Governing Body decided that there should be one unified scheme under the control of one officer designated the Locust Research Entomologist with headquarters at Lyallpur, but there should be one Deputy Locust Research Entomologist

to assist him with headquarters at Quetta in Baluchistan, at a total cost not exceeding Rs. 1,76,000.

2. The scheme was started in December 1930 for one year in the first instance and with the approval of the Hon'ble the Chairman, Mr. Afzal Husain, Entomologist, Punjab, was appointed the Locust Research Entomologist in charge of the entire scheme and Rao Sahib Y. Ramachandra Rao, Entomologist, Madras, as Deputy Locust Research Entomologist and the staff shown in Enclosure II.

After inspection by the Agricultural Expert (Mr. D. Milne) and the Vice-Chairman, it was decided that the period of employment of the major portion of the staff should be extended for the present upto 31st March 1932, and that a field laboratory at Pasni and two observation posts at Ormara and Sonmiani in South Baluchistan should be established with effect from January 1932. The present strength at the various places has been detailed in the statement enclosed (Enclosure II).

3. As outlined in the scheme, the research in the plains area has been confined to Bionomics and control measures and that in Baluchistan, Rajputana and Sind, to the locust surveys.

Copies of reports (Not Printed) showing the work done at Lyallpur and Quetta so far are enclosed.

4. Statements (Enclosure III) are enclosed showing the actual expenditure incurred upto the end of November 1931 and the estimated expenditure for the extended period upto the end of March 1932. The total expenditure comes to about Rs. 1,27,000 leaving a balance of Rs. 49,000 of the amount sanctioned by the Governing Body.

5. In this connection it may be noted that in the scheme drawn up by Mr. M. Afzal Husain it was emphasised that the fact that the staff was employed for one year in the first instance should not be taken to indicate that no staff would be required after one year or that work could be completed in that period. It was realised from the outset that a larger period would be required but it was impossible to forecast requirements.

6. At the request of the Locust Research Entomologist a Russian Translator, Mrs. Makeeff, has been employed since August last to translate the most important of the Russian literature on locust work. She has been able to translate so far about ten articles and much work still remains to be done. Her present term expires at the end of January. The literature in other languages, *e.g.*, French and German is being translated by some of the Indian staff.

7. The following points are now for the consideration of the Locust Committee :—

- (1) The programme of future work of locust research scheme (a) at Lyallpur, (b) in Baluchistan.
- (2) The staff required and the period for which it should be engaged.
- (3) Provision to be made for laboratory field and other contingent expenditure.
- (4) Future arrangements for the translation of Russian literature.
- (5) Financial provision required.

M. S. A. HYDARI,

Secretary.

The 11th January 1932.

## ENCLOSURE II.

*Staff at Lyallpur—*

1. Locust Research Entomologist.			
2. Assistant Research Entomologists	..	..	2
3. Research Assistants	..	..	5
4. Clerks	..	..	2
5. Fieldmen	..	..	9
6. Peons	..	..	4

*Additions.*

7. Russian Translator	..	..	1
8. Clerk	..	..	1
9. Motor Driver for the lorry	..	..	1
10. Assistant Locust Research Entomologist	..	..	1

*Staff at Quetta—*

1. Deputy Locust Research Entomologist	..	..	1
2. Assistant Locust Research Entomologist	..	..	1
3. Research Assistants	..	..	3
4. Clerks	..	..	2
5. Fieldmen	..	..	6
6. Peons	..	..	2

*Distribution of staff in January 1932.*

Lyallpur.	Quetta.	Survey Party.	Pasni Laboratory.
Locust Research Entomologist.	Deputy Locust Research Entomologist.	Research Assistants .. 2	Assistant Locust Research Entomologist .. 1
Assistant Research Entomologist. 1	Clerk .. 1 Peon .. 1	Fieldmen .. 6 Motor Driver .. 1	Research Assistant. .. 1
Research Assistants 3	Fieldman .. 1	Peon .. 1	Fieldmen .. 6 Peon .. 1
Clerks .. 3			
Russian Translator 1			
Peons .. 3			
Fieldmen .. 6			

NOTE.—One Research Assistant left in May and two Assistant Research Entomologists and one Research Assistant were disbanded on the expiry of their terms.

ENCLOSURE III.

Actuals, 1930-31.

Lyalpur.			Quetta.				
	Rs.	A.	P.		Rs.	A.	P.
Pay of Officers— Entomologist .. ..	4,134	4	0	Pay of officers— Deputy Entomologist and Assistant Research Entomologist.	3,532	4	0
Total Pay of Officers ..	..	..	..	Total pay of Officers ..	..	..	..
Pay of Establishment— Assistant Research Entomologist ..	1,471	0	0	Pay of Establishment— Research Assistants .. ..	850	0	0
Research Assistants, Clerks and In- ferior servants.	2,785	14	0	Clerks and Inferior servants ..	414	2	0
Total pay of Establishments ..	..	..	..	Total pay of Establishment ..	..	..	..
Allowances and Honoraria, etc.— T. A. of Officers .. ..	457	2	0	Allowances and Honoraria, etc.— T. A. of Officers .. ..	751	2	0
T. A. of Establishment .. ..	247	2	0	T. A. of Establishment .. ..	951	8	0
Total ..	..	..	..	Total ..	..	..	..
Grants-in-aid, contributions, etc.— Leave and Pension contributions ..	1,317	14	0	Grants-in-aid, contributions, etc.— Leave and pension contributions	..	..	..
Total ..	..	..	..	Contingencies, Supplies and Ser- vices.	..	..	..
Contingencies, Supplies and Ser- vices.	..	..	..	Grand Total ..	..	..	..
Grand Total ..	..	..	..				

Total of Lyalpur and Quetta .. .. Rs. 19,065 4 7

1931-32.

Actuals upto 30th November 1931.

Lyallpur.			Quetta.		
	Rs. A. P.	Rs. A. P.		Rs. A. P.	Rs. A. P.
Pay of Officers— Entomologist .. .. .	10,500 0 0	..	Pay of Officers— Deputy Locust Research Entomologist, and Assistant Research Entomologist.	11,125 13 0	..
<b>Total pay of Officers</b> ..		10,500 0 0	<b>Total pay of officers</b> ..	..	11,125 13 0
Pay of establishments— Assistant Research Entomologists ..	4,904 13 0	..	Pay of establishments— Research Assistants .. .. .	2,825 13 0	..
Research Assistants, Clerks and Inferior Servants.	11,376 6 0	..	Clerks and Inferior servants ..	2,566 4 0	..
<b>Total pay of establishment</b> ..		16,281 13 0	<b>Total pay of establishments</b> ..	..	5,392 11 0
Allowances, Honoraria, etc.— T. A. of officers .. .. .	549 0 0	..	Allowances, Honoraria etc.— T. A. of officers .. .. .	2,935 3 0	..
T. A. of establishment .. .. .	1,799 5 0	..	T. A. of establishments .. .. .	2,715 6 0	..
<b>Total Allowances, Honoraria, etc.</b>	..	2,348 5 0	<b>Total Allowances, Honoraria, etc.</b>	..	5,650 9 0
Grants-in-aid, contributions, etc.— Leave and Pension contributions ..	..	3,784 1 0	Grants-in-aid, contributions, etc.— Leave and Pension contributions ..	..	2,657 10 0
Contingencies, supplies and services	7,060 10 8	..	Contingencies, supplies and services	..	4,000 15 0
<b>Grand Total</b> ..	..	39,974 6 8	<b>Grand Total</b> ..	..	28,827 0 0

Total for Lyallpur and Quetta .. Rs. 68,801 6 8

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Statement for 4 months December 1931 to March 1932.

Lyalpur.			Quetta.				
	Rs.	A. P.	Rs.	A. P.	Rs.	A. P.	
<b>Pay of Officers—</b>					<b>Pay of Officers—</b>		
Locust Research Entomologist ..	6,700	0 0	..		Deputy Locust Research Entomologist.	3,600	0 0
<b>Pay of Establishments—</b>					<b>Pay of Establishments—</b>		
Assistant Locust Research Entomologist.	1,000	0 0	..		Research Assistants .. ..	2,900	0 0
Research Assistants .. ..	2,900	0 0	..		Clerks and Inferior servants ..	2,100	0 0
Clerks and Inferior servants ..	1,600	0 0	..		<b>Allowances and Honoraria, etc.—</b>		
<b>Allowances and Honoraria, etc.—</b>					T. A. of Officers .. ..	3,000	0 0
T. A. of officers .. ..	1,000	0 0	..		T. A. of establishments .. ..	4,000	0 0
T. A. of establishments .. ..	1,200	0 0	..		<b>Grants-in-aid, contributions, etc.—</b>		
<b>Grants-in-aid, Contributions, etc.—</b>					Leave and pension contributions ..	1,300	0 0
Leave and pension contributions ..	1,700	0 0	..		Contingencies, supplies and services	3,800	0 0
Contingencies, supplies and services	2,000	0 0	..				
<b>Grand Total</b> ..	<b>18,100</b>	<b>0 0</b>	<b>..</b>		<b>Grand Total</b> ..	<b>21,000</b>	<b>0 0</b>

Total for Lyalpur and Quetta .. Rs. 39,100 6 6

Total .. Rs. 1,27,000 0 0



## ENCLOSURE IV.

*Probable expenditure for one year from April 1932.*

*Lyallpur.*

	Rs.
<i>Pay of officers—</i>	
Locust Research Entomologist .. .. .	16,700
<i>Pay of establishment—</i>	
Research Assistants (3) .. .. .	5,500
Fieldmen (6) .. .. .	1,800
Clerks (3) .. .. .	2,370
Peons (3) .. .. .	540
Russian Translator .. .. .	3,780
<i>Allowances and honoraria, etc.—</i>	
T. A. of officers .. .. .	3,000
T. A. of establishment .. .. .	6,200
<i>Grants-in-aid, contributions, etc.—</i>	
Leave and pension contributions .. .. .	5,100
Contingencies, supplies and services .. .. .	6,000
	50,990
	or
	51,000

*A.—Quetta.*

	Rs.
<i>Pay of Officers—</i>	
Deputy Locust Research Entomologist .. .. .	10,800
<i>Pay of Establishment—</i>	
Clerk (1), Peon (1) and Fieldman (1). One Research Assistant .. .. .	3,220
<i>Allowances and Honoraria, etc.—</i>	
T. A. of Officers .. .. .	5,300
T. A. of Establishment .. .. .	2,400
<i>Grants-in-aid, contributions, etc.—</i>	
Leave and Pension contribution .. .. .	3,000
Contingencies, supplies and services .. .. .	3,500
<b>Total</b> .. .. .	<b>28,220</b>

*B.—Survey Party.**Pay of Establishment—*

Research Assistants (2), Collectors and Fieldmen (3), Motor Driver (1), and Peon (1) .. ..	6,500
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*Allowances and Honoraria—*

T. A. of Establishment .. ..	8,800
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*Grants-in-aid, contributions, etc.—*

Leave and pension contribution .. ..	900
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Contingencies, supplies and services .. ..	500
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16,700

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*C.—Pasni.**Pay of Establishment—*

Assistant Locust Research Entomologist (1), Research Assistant (1), Fieldmen and Collectors (6), and Peon (1) .. ..	9,500
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*Allowances and Honoraria, etc.—*

T. A. of Establishment .. ..	5,000
------------------------------	-------

*Grants-in-aid, contributions, etc.—*

Contingencies, supplies and services .. ..	800
--	-----

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15,300

---

28,220

16,700

15,300

---

Total .. .. 60,220

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Total of Lyallpur and Quetta .. ..	51,000
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60,220

---

1,11,220

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**APPENDIX XIX.**

**SUBJECT No. 20.**

**PROCEEDINGS OF THE FIRST AND SECOND MEETINGS OF THE  
INDIAN OIL CRUSHING INDUSTRY COMMITTEE APPOINTED BY  
THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.**

The attached copies (Not printed) of the First and Second Meetings of the Indian Oil Crushing Industry Committee appointed by the Imperial Council of Agricultural Research held in May and December 1931, respectively, are circulated for the information of the Advisory Board.

**M. S. A. HYDARI,**

*Secretary.*

**NEW DELHI,**

*The 23rd January 1932.*

## APPENDIX XX.

SUBJECT No. 21.

## PROPOSALS FOR THE ESTABLISHMENT OF A BUREAU OF INFORMATION AND STATISTICS AND THE APPOINTMENT OF A CENTRAL COMMITTEE FOR OIL-SEEDS.

Attention is invited to the attached Report (Enclosure I), submitted by the Indian Oil Crushing Industry Committee appointed by the Imperial Council of Agricultural Research on the establishment of a Bureau of Information and Statistics and the appointment of a Central Committee for Oil-seeds. The personnel of the present Committee will be found in Enclosure II.

The subject is now for the consideration of the Advisory Board.

M. S. A. HYDARI,

*Secretary.*

*The 21st January 1932.*

## ENCLOSURE I.

*Draft Report.*

At its first meeting, the Indian Oil Crushing Industry Committee decided to examine the question of (1) establishing a Bureau of Information and Statistics for oil-seeds, oils and oil products, and (2) the establishment of a Central Body on the lines of the Indian Central Cotton Committee to take up research on oil-seed crops and products, marketing problems and to deal with matters of concern to the agriculturist, factory owner and trader. The opinion of Chambers of Commerce and similar bodies were invited on the Committee's agenda and in particular, they were asked for an opinion on the feasibility of establishing a Central Committee financed by a cess.

2. The replies received from commercial bodies indicate a very considerable measure of support for the proposal to establish a Central Committee but there was not the same measure of agreement on the proposals to raise funds by a cess. The cess of eight annas per ton suggested at the first meeting of the Committee was considered high in proportion to the value of oil-seeds exported; the question was also raised as to whether an export cess alone was sound in principle.

3. At its second meeting, the Committee decided that the present was not an appropriate time to put forward proposals for raising money by a cess but that an attempt might be made to establish a Central Committee as an advisory body and to provide it with a small permanent staff and an Information Bureau if the cost of such could be met by the Imperial Council of Agricultural Research. In coming to this decision, the Committee were influenced by the fact that the Indian Central Cotton Committee existed as an advisory body (with a permanent staff and an information bureau) for a period of two years before it obtained funds from a cess; that during that period it dealt successfully with several important matters connected with the organisation of the trade and prepared a well thought out programme of agricultural and technological research. The Cotton Committee started with the initial advantage that a valuable survey of the industry had been carried out by the touring Committee of 1917 (the Indian Cotton Committee); for oil-seeds and the oil-crushing industry most of this preliminary survey has yet to be carried out. It was felt, therefore, that an advisory committee with a staff to carry on work in the interval between meetings could perform very useful work; especially as specific proposals for research work need not necessarily wait for the

provision of funds by a cess but can be submitted to the Imperial Council of Agricultural Research.

A Central Committee which would have control of substantial funds raised by an oil-seeds cess would need to be of a representative character. As oil-seeds are of importance to most provinces and many States and since provision has to be made for the representation of the grower, the industrialist, and the trader as well as the Agricultural and Industries Departments, the Committee would need to consist of about 40 members, the original Indian Central Cotton Committee was nearly as large as the Committee incorporated by the Cotton Cess Act of 1923 and at once there would be definite advantages in establishing a representative Central Oil-seeds and Oil Industry Committee. But the experience of the Central Cotton Committee indicates that a committee of such size, if it were to be a live body, would necessitate even at the outset, an annual expenditure of over Rs. 50,000. Under present financial circumstances, it would seem necessary to start on a more modest scale. The suggestion is therefore put forward that for the time being the present committee, which though small is of a representative character, should constitute the Central Committee additions to their number not exceeding 6 being made as the need for representations of special interests appear. Two immediate additions to represent the export and merchanting aspect would seem necessary, *vis.*, one member each to represent the Associated Chambers of Commerce and the Federation of Indian Chambers, respectively. The present committee contains no representative of agricultural departments and agricultural interests and would be much strengthened by the addition of two officers with special experience in agricultural research on oil-seeds, and one or two representatives of growers of oil-seeds and an Economist to advise on economic and fiscal matters.

The Bureau of Information and Statistics with which it is proposed to provide the committee is to collect information and statistics which will be passed on to the industry on the lines adopted by the Sugar Bureau at present. The Bureau would also study the position of the industry, collect statistics of the quantities of various oil-seeds available, where they are consumed, details of oil and oil-products manufactured in India and imported and in general information regarding the production, marketing and consumption of oil-seeds and their products; it would also obtain information relating to foreign markets and of the progress of the oil-crushing industry in other countries. It is intended that the Bureau should also issue a quarterly or half yearly technical bulletin for the assistance of the oil-seed trade and oil-crushing industry.

6. Turning to the question of cost, the Sugar Bureau is a good parallel and (excluding the cable service which is a special self-supporting branch) has the following staff:—

One Head Clerk, One typist, Two clerks,	}	Total cost Rs. 4,860 rising
5 peons and menials.		to Rs. 5,604 in 3rd year.

The Sugar Technologist to the Imperial Council of Agricultural Research also acts as Secretary of the Sugar Bureau. Eventually the Oil Seeds Committee will doubtless require a highly qualified technical Secretary but in the meantime a Secretary who can run the office, look after the statistics and work up the material provided by the Committee, might suffice. This would cost say Rs. 6,000 per annum allowing Rs. 5,000 for travelling allowance of members and staff and Rs. 3,000 for office expenses and contingencies. The annual cost of the committee would come to say Rs. 20,000. For reasons of economy, it would be desirable to have the office of the Committee at Delhi. The above appears to be exceedingly modest expenditure on such an important group of problems even during a period of financial stringency.

7. To summarize it is recommended that the Imperial Council of Agricultural Research should establish a permanent central oil-seeds and vegetable oil-products committee consisting of about 16 members, with a full-time Secretary and with a small information and statistical bureau, at an estimated cost of Rs. 20,000 per annum. The question of enlarging the committee and of providing it with adequate funds by means of a cess or otherwise should be further examined by the committee now proposed with a view to action being taken when circumstances are favourable.

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ENCLOSURE II.

*List of members of the Indian Oil Crushing Industry Committee.*

1. Diwan Bahadur Sir T. Vijayaraghavacharya, K.B.E., *Chairman, ex-officio.*
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. Mr. S. D. Saklatwala, Tata Sons, Ltd., Bombay House, Fort, Bombay.
4. Mr. W. Roberts, B.Sc., Empire Cotton Growing Association, Khanewal, Punjab.
5. Mr. A. Kesava Menon, B.A., F.C.S., Oil Chemist and Soap Expert, Calicut, Madras.
6. Mr. J. A. H. Duke, Oil Expert, Cawnpore, U. P.
7. Mr. Ratilal Mulji Gandhi, B.A., President, The Seed Traders' Association, Bombay No. 3.
8. Haji Abdulla Haroon, M.L.A., Napier Road, Karachi.
9. Mr. J. H. Walker, A.R.T.C., A.I.C., Manager of the Gourepur Oil Mills, 2, Fairlie Place, Calcutta.
10. Sh. Muhammad Ismail of Messrs. Sh. Mohammed Ismail Maula Bux, Lyallpur.
11. Mr. G. A. Mahamadi, Director of Commerce and Industry, H. E. H. the Nizam's Government, Hyderabad.

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Mr. M. S. A. Hydari, I.C.S., *Secretary, ex-officio.*

## APPENDIX XXI.

SUBJECT No. 22.

## APPLICATION FROM THE GOVERNMENT OF BENGAL FOR THE APPOINTMENT OF A CIGAR CURING AND BLENDING EXPERT FOR INDIA AND ESPECIALLY FOR MADRAS, BENGAL AND BURMA.

Attention is invited to the attached letter (Enclosure I) from the Government of Bengal, No. 58-T. A. I., dated the 24th April 1931, recommending *inter alia* a scheme for the appointment of a cigar curing and blending expert for India and especially for Madras, Bengal and Burma. The scheme which involves a non-recurring and recurring expenditure of Rs. 3,924 and Rs. 1,16,240 respectively or a total of Rs. 1,20,164 spread over a period of five years was considered (Enclosure II) at the last meeting of the Advisory Board, held in June 1931, and it was decided to invite Provinces other than Bengal to submit schemes of research dealing with their particular tobacco problems for consideration along with the Bengal scheme (Enclosure I).

2. The Local Governments (including the North-West Frontier Province and the Governments of H. E. H. the Nizam and H. H. the Maharaja of Mysore) were accordingly invited to forward any schemes that they may have to submit in this connection. Their replies will be found in Enclosure III.

3. The Bengal Provincial Agricultural Research Committee have approved the Bengal scheme at their meeting held on the 7th November 1931 (Enclosure IV).

4. A copy of a note by the Agricultural Expert to the Imperial Council of Agricultural Research is also appended (Enclosure V).

The subject is now submitted for the consideration of the Advisory Board.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

*The 8th January 1932.*

## ENCLOSURE I.

COPY OF LETTER FROM THE SECRETARY TO THE GOVERNMENT OF BENGAL, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. 58-T. A. I., DATED THE 24TH APRIL 1931.

In continuation of my telegram No. 1805, dated the 2nd April 1931 (not printed), I am directed to forward herewith the following schemes which have been approved by the Provincial Agricultural Research Committee, Bengal, for inclusion in the Agenda of the next meeting of the Advisory Board of the Imperial

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Council, together with relevant extracts from the minutes of the Committee meeting on the subject :—

1. Scheme proposing appointment of a cigar curing and blending expert for India and specially for the Provinces of Madras, Bengal and Burma.

2. . . . .

These schemes have also been approved by the Government of Bengal (Ministry of Agriculture) on condition that no financial liability devolves on them.

One hundred spare copies of the schemes will follow.

*Extract from the minutes of the meeting of the Provincial Agricultural Research Committee held at Dacca on the 15th April 1931.*

“4. Though no definite scheme regarding tobacco was then before it at its meeting in November last the Provincial Agricultural Research Committee approve the idea of an investigation into the curing and blending of cigar tobacco leaf and the appointment of an expert for the same. The Director of Agriculture and Mr. Carbery explained the scheme to the Committee, pointing out that ordinary tobacco is now probably the most paying revenue crop for the cultivator and that production of finer tobacco leaf for export is at present approximately twice as profitable to the cultivator as ordinary tobacco. From the point of view of the raiyat therefore there is every reason for encouraging the production of fine tobacco on a large scale. It was also explained to the Committee that the scheme as drafted has been submitted to and approved by the Directors of Agriculture in Burma and Madras respectively. The Committee decided to recommend the scheme to the Advisory Board.”

*Scheme proposing appointment of a Cigar Curing and Blending Expert for India and especially for the Provinces of Madras, Bengal and Burma..*

Amongst the resolutions carried by the Board of Agriculture in India of 1925 was one calling for the appointment of a tobacco curing expert. Since that time flue-curing of Virginia tobaccos for cigarette making has made great advances and the need for an expert for these is no longer essential.

With cigar tobaccos, however, the case is different. The process of curing is, to begin with, very much longer and more difficult than with other types and expert supervision can at this stage make all the differences between a grade “A” product and grade “C.” In two Provinces at least cheroot tobacco cultivation is expanding and as the present staff have not had much experience in the all-important processes of drying and fermenting, the necessity for the appointment of an expert is apparent. From the cultivator’s point of view these cheroot tobaccos offer him very high remuneration for his crop; indeed it is doubtful whether any other economic crop or even other types of tobaccos can show such a profitable return at present.



A short history of exotic cheroot tobaccos in Bengal might not be out of place. Sumatra seed was obtained about 1910 and was sown at the Government Tobacco Farm, Rungpur, which farm is on the edge of the Northern Bengal tobacco tract. The tobacco was acclimatised fairly rapidly, and by 1915 a characteristic leaf was obtained, which has shown little or no change since. The drying and curing also met with fair success. Cheroots were made and sold in small quantities. Further at the end of the war, when wrapper leaf was almost unobtainable, this Sumatra grade "A" was sold in Madras at Rs. 250 per maund. After the war new filler types were introduced and of these two have proved successful. They also may be said to be now acclimatised. Later all tobaccos, except cheroot types and 2 improved selections of *deshi*, were removed from the tobacco farm and the area under cheroot tobaccos on the farm was thus considerably increased. The manufacturing part was brought to Dacca, and several apprentices were engaged under an expert roller so that at present nearly 30,000 cheroots per month are made. These are readily bought. A private company has also been recently formed, which has taken over the arrangements with cultivators for growing these cigar tobaccos; and next season over 500 acres will be under these types. The chief difficulty at present is lack of trained staff, but it will be seen that the cultivation of these tobaccos has made such a good start as to deserve every encouragement and help.

It is therefore proposed that an expert should be appointed who should be

- (1) thoroughly experienced in the drying and fermenting of cheroot tobaccos,
- (2) capable of finishing and grading those tobaccos when cured into recognised standards, and
- (3) if possible also able to blend for cheroot manufacture where advisable.

In each case, however, it is known that the production of exotic leaf, though already much more profitable than that of ordinary tobacco to the cultivator, is capable, under expert handling, of yielding still greater returns.

Tobacco is one of the comparatively few revenue crops in India and its cultivation should be encouraged not only on this account, but because the best agricultural practice is necessary for success. Apart from Bengal, Madras and Burma, tobacco is an important crop in North Bihar, which, with other provinces would certainly benefit from expert supervision in the three provinces from which the application emanates.

With reference to the sharing of the services of the expert by the three provinces concerned, this would not be a difficult matter. It does not seem possible or advisable to lay down a typical programme. In the first year the officer would be chiefly occupied in a preliminary survey, and the Directors of Agriculture concerned are unanimous that subsequent programmes would much better be decided on in consultation with the officer himself.

As regards the actual work the officer would do, the scheme contemplates experimental curing houses in each province, the results obtained by the expert in which would ultimately be demonstrated departmentally to whomsoever would desire it. It could not be expected that the expert would have time to instruct individual small men though he would probably be able to help large producers or groups of smaller men.

The total cost of such scheme covering five years would be Rs. 1,20,164 consisting of recurring Rs. 1,16,240 and non-recurring Rs. 3,924.

Details of the proposed expenditure are given below :—

	First year.	Second year.	Third year.	Fourth year.	Fifth year.
	Rs.	Rs.	Rs.	Rs.	Rs.
Recurring—Staff—					
1 Expert Curer .. ..	14,400	15,000	15,800	16,200	16,800
1 Clerk .. ..	420	420	480	480	540
1 Peon .. ..	180	180	180	180	180
Travelling allowance, office contingencies, office expenses and miscellaneous	6,000	6,000	6,000	6,000	6,000
	1,000	1,000	1,000	1,000	1,000
<b>Total ..</b>	<b>22,000</b>	<b>22,600</b>	<b>23,260</b>	<b>23,860</b>	<b>24,520</b>

Rs.

Non-recurring—Furniture, etc.—

1 Typewriter .. ..	375
2 Tables, office .. ..	150
1 Typewriter table .. ..	25
2 Whatnots .. ..	35
6 Chairs .. ..	54
2 Almirahs .. ..	110
1 Portable typewriter .. ..	175

924

Temporary curing shed for each of 3 provinces at Rs.

1,000 each .. .. 3,000

Total	{	Non-recurring ..	3,924
		Recurring ..	1,16,240

Grand Total .. .. 1,20,164

ROBERT S. FINLOW,  
Director of Agriculture, Bengal.

RAMNA (DACCA),  
The 30th October 1931.

## II

SUPPLEMENTARY INFORMATION IN CONNECTION WITH THE APPLICATION FROM  
MADRAS, BURMA AND BENGAL FOR A GRANT FOR RESEARCH INTO CIGAR TOBACCO  
CURING AND BLENDING.

	Madras Acres.	Bengal Acres.	Burma Acres.
Area under tobacco .. ..	260,000	250,000	..
Profits per acre from cultivation of—			
(a) Local tobacco .. ..	<i>Nil</i> at present prices.	<i>Nil</i> at present prices.	..
(b) Exotic tobacco .. ..	1s profitable.	Rs. 120	..

In view of the apparently imminent separation of Burma from India, the Director of Agriculture in Burma has not yet provided statistics from his province, but has been asked to put in a separate note on the subject. The Madras Director has furnished such information as is included herewith, but he has also been asked to furnish a supplementary note.

In Bengal the position is that Departmental tobacco investigations have culminated so far in the manufacture and sale of about 30,000 cheroots a month. This is only a beginning for the demand is much greater than the supply and there is certainly a very large local market (in India) for small cheroots of good tobacco. At the same time exotic leaf produced in Bengal has been favourably commented on in London, as regards intrinsic quality, but it is criticised as regards curing and generally in preparation for the market.

Recently a commercial firm has taken over the development of cigar tobacco in Bengal and, in the last season, about 2,000 maunds (about 75 tons) of leaf have been produced by cultivators under the auspices of the Company, which has paid an average price double that of local tobacco. The next season will see a large increase in exotic tobacco cultivation in Bengal, both for local consumption and for export.

The Director of Agriculture in Madras remarks as follows :—

“We have in Madras 3 main cheroot-making centres, Cocanada, Trichinopoly and Dindigul, where the industry is well established. We have also a good export trade from Cocanada of leaf to Burma for cheroots. We hear complaints of the quality of cheroot tobacco and there is no doubt that Madras cheroots could be improved; but we have not been able to tackle the job.”

It will then be seen that both Madras and Bengal have a considerable and growing cigar leaf production and cheroot manufacture. The same applies to Burma.

In each case however it is known that the production of exotic leaf, though already much more profitable than that of ordinary tobacco to the cultivator, is capable, under expert handling, of yielding still greater returns.

Tobacco is one of the comparatively few revenue crops in India and its cultivation should be encouraged not only on this account, but because the best agricultural practice is necessary for success. Apart from Bengal, Madras and Burma, tobacco is an important crop in North Bihar, which, with other provinces, would certainly benefit from expert supervision in the three provinces from which the application emanates.

With reference to the sharing of the services of the expert by the three provinces concerned :—This would not be a difficult matter. It does not seem possible or advisable to lay down a typical programme. In the first year the officer would be chiefly occupied in a preliminary survey, and the Directors of Agriculture concerned are unanimous that subsequent programmes would much better be decided on in consultation with the officer himself.

As regards the actual work the officer would do :—The scheme contemplates experimental curing houses in each province, the results obtained by the expert in which would ultimately be demonstrated departmentally to whomsoever would desire it. It could not be expected that the expert would have time to instruct individual small men though he would probably be able to help large producers or groups of smaller men.

ROBERT S. FINLOW,  
*Director of Agriculture, Bengal.*

DACCA,

*The 30th May 1931.*

### III

COPY OF NOTE BY THE DIRECTOR OF AGRICULTURE, MADRAS, DATED THE 31ST MAY 1931.

The average area under tobacco in the Presidency for the last ten years ending 1929-30 is 236,000 acres. It is a cash crop of importance and except perhaps in the case of cigarette tobacco, it yields fairly handsome returns to the cultivator—Rs. 200—Rs. 300 may be said to be an average net return per acre. There are in Madras three main cheroot-making centres, Cocanada, Trichinopoly and Dindigul where the industry is well established. There is also a good export trade from Cocanada of leaf to Burma for cheroots. "Sivapuri" tobacco grown near Chidambaram also finds a ready market in Burma. The chief drawback, however, is the non-availability of suitable 'wrapper' tobacco in the country due to which manufacturing firms import such tobacco. Research in the direction of obtaining the right quality of wrapper and filler tobacco and general improvement in the cultural and manurial methods would place the cigar industry in the Presidency in a much better position than it at present enjoys. The department has so far not found the time and staff to carry out investigations in these directions.

One of the duties of the officer would be to tour in different localities where tobacco curing is practised in order to teach the people the art of proper curing and blending tobacco but it seems to me unnecessary at this stage to go into such details as to give even a rough programme of his movements in the Province.

## ENCLOSURE II

*Extract from the Proceedings of the Advisory Board, June 1931.*

4. *Application from the Government of Bengal for the appointment of a cigar curing and blending expert for India and specially for Madras, Bengal and Burma.*—Mr. McLean introduced the scheme. Mr. Milne said that in these days of agricultural depression it was necessary to find better paying crops than cotton, wheat or rice and he considered that tobacco might be one of such substitute crops. There were already about a million acres of tobacco grown in the various provinces of India but chiefly in Bengal, Madras, Bombay, Bihar and Orissa and Burma. He did not, however, feel very happy about the location of the expert's headquarters at Calcutta. In his opinion his head-quarters should be at some place like Dacca, Madras or Pusa where he could be supervised. Further, he thought that as the Bengal Government stood directly to benefit by this scheme they might contribute a little towards its cost. It might not be very much but even a little would mark a sense of the importance which they attached to this scheme. Dr. Hyder enquired whether the area under tobacco was scattered or concentrated. This question would become of importance in the not distant future if Government for revenue purposes wanted to establish a tobacco monopoly. Professor Ganguli said that Dr. Shaw was doing some research on tobacco at Pusa and he did not quite appreciate the need for this scheme of research in Bengal. If, however, such research was necessary it should be centralized at Pusa. Mr. Henderson also desired that research should be centred at Pusa which was situated in a homogeneous tobacco-growing tract. Dr. Mehta said that the scheme was more industrial than agricultural. It would benefit the manufacturer of cigars and cigarettes much more than the grower of tobacco—an opinion in which Dr. Agharkar agreed. The Harcourt Butler Technological Institute at Cawnpore had submitted to the Council a scheme for sugar technology which the latter had sanctioned but towards the cost of which the United Provinces Government had made a substantial contribution. In the present scheme, on the contrary, all the cost had to be borne by the Council. He suggested that manufacturing firms should be invited to share the expenses of the scheme with the Council. Mr. McLean replied that the ryots in Bengal did their own curing. The price which they got for their tobacco depended upon the quality of the curing. Rao Bahadur Ananda Rao said that though Madras was sought to be included within the purview of this scheme their problems were somewhat different. There were four purposes for which tobacco was used in Madras : as snuff, for chewing, for cigarettes and for cheroots. For the two former the local methods of curing seemed adequate. Cigarette and cigar manufacture in Madras was in the hands of big firms who were devoting their attention to the problem of curing. So far as cigars were concerned the question was not so much of curing as the growing of a tobacco which would be suitable as a wrapper for cigars. Tobacco for filling cigars presented no difficulty. The experience of ryots in the matter of growing tobacco for cigarette manufacture had not been particularly happy. They had been induced by firms to grow such tobacco in districts like Guntur, but last year when the price dropped a lot of that tobacco was left on their own hands and some of it had to be used as manure. Ryots would have to think twice before they again grew tobacco for cigarette making in Madras on any large scale at the instance of firms. On the whole, therefore, he thought that the problem of more immediate importance to Madras was research into the growing of a tobacco which would be useful as a wrapper. Dr. Keen said that the scheme was primarily an industrial investigation. He was

not sure that the suggestion that the tobacco curing expert should be located at Pusa was a sound one. Pusa was essentially a centre for the conduct of fundamental agricultural research. While he would not oppose the head-quarters of the expert being at Pusa he thought the latter would be in an unsuitable environment there and he would prefer him being placed elsewhere. The general feeling in the Board was that as was shown in the case of Madras, provinces might each have their own particular problem in the matter of tobacco research to tackle and that they should all, including the Bengal scheme, be considered together.

In the result the Board decided to invite provinces to submit schemes of research dealing with their particular tobacco problems for consideration along with the Bengal scheme at the Board's next meeting.

### ENCLOSURE III.

#### REPLIES RECEIVED FROM LOCAL GOVERNMENTS, ETC.

##### I

LETTER FROM H. G. DENNEHY, Esq., I.C.S., OFFICIATING SECRETARY TO THE GOVERNMENT OF ASSAM, TRANSFERRED DEPARTMENTS, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 2175-E., DATED SHILLONG, THE 7TH OCTOBER 1931.

I am directed to acknowledge the receipt of your letter (not printed) No. 2209-Agri., dated the 8th September 1931, and to say that, as tobacco is not an important crop in Assam the Government of Assam do not propose to submit any scheme for research.

##### II

LETTER FROM G. P. BURTON, Esq., I.C.S., SECRETARY TO THE GOVERNMENT OF THE CENTRAL PROVINCES, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. C-54-814--XIV, DATED NAGPUR, THE 17TH OCTOBER 1931.

With reference to your letter No. 2209-Agri., dated the 8th September 1931 (not printed), I am directed by the Government of the Central Provinces (Ministry of Agriculture) to say that tobacco is grown in this province only in small areas and in widely varying conditions and consequently the local department of agriculture in this province has no scheme of research on this crop which it would like to submit for the consideration of the Imperial Council of Agricultural Research.

##### III

LETTER FROM R. M. MACDOUGALL, Esq., SECRETARY TO THE GOVERNMENT OF BURMA, LOCAL GOVERNMENT DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 423-O., DATED RANGOON, THE 22ND OCTOBER 1931.

I am directed to acknowledge the receipt of your letter No. 2209-Agri., dated the 8th September 1931 (not printed), forwarding a scheme approved by the Bengal Agricultural Research Committee for the appointment of a Cigar Curing and Blending Expert for India and specially for the Provinces of Madras, Bengal

and Burma and asking for a scheme of research on tobacco from Burma for consideration along with the Bengal scheme at the next meeting of the Advisory Board of the Imperial Council of Agricultural Research in January 1932.

2. In reply I am to say that in Burma the area under tobacco is approximately 100,000 acres and is almost entirely confined to the "Kaing" (aluvial) land along the river. The Government of Burma (Ministry of Forests) does not think that tobacco would be successfully grown inland and, apart from the "Kaing" area, there are no large stretches of suitable land such as exist in Bihar. The possibilities of expansion are thus, under present market conditions, limited. Nevertheless attempts have been made, though on a very small scale, to improve the Burma tobacco, but progress has been very slow. In the opinion of this Government commercial firms are in a better position to tackle the improvement of cigars and cigarettes than is a Government department. In any case even if the latter did appoint experts little could be done unless some commercial firm took the matter up and got into touch with the growers of tobacco on the spot. This Government is also doubtful if, assuming that a suitable expert could be recruited, a satisfactory method of apportioning his time and services among the three provinces concerned could be devised.

3. I am accordingly to suggest that before embarking on a scheme which is likely to cost a good deal of money the Imperial Council should invite the opinion of the large tobacco firms in India regarding, firstly, the necessity for such an expert, and, secondly, the possibility of putting to practical use any improvements that he might effect.

## IV

LETTER FROM THE SECRETARY TO THE GOVERNMENT OF HIS HIGHNESS THE MAHARAJA OF MYSORE, DEVELOPMENT DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. D-2664/A. AND E-55-31-2, DATED BANGALORE, THE 13TH|15TH OCTOBER 1931.

With reference to your letter No. 2209-Agri., dated 8th September 1931 (not printed), calling for a scheme of research, if any, dealing with tobacco problems in this State for consideration along with the Bengal scheme at the meeting of the Advisory Board in January 1932, I am directed to state that this Government have no scheme to put forward in this connection.

## V

LETTER FROM BABU PARESH NATH MAZUMDAR, B.A., ASSISTANT SECRETARY TO THE GOVERNMENT OF BIHAR AND ORISSA, EDUCATION AND DEVELOPMENT DEPARTMENT, TO THE SECRETARY TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 1850-D., DATED PATNA, THE 3RD NOVEMBER 1931.

In reply to your letter No. 2209-Agri., dated the 8th September 1931 (not printed), I am directed to say that the local Government have, at present, no scheme of research, dealing with tobacco problems for consideration at the next meeting of the Advisory Board of the Imperial Council of Agricultural Research. They are, however, in full sympathy with the schemes put forward by the Governments of Madras, Burma and Bengal and would very much like that the services of the tobacco expert may be made available for this province occasionally for advisory purposes. I am accordingly to request that arrangements may kindly be made so that this province may have the benefit of his services for about a month each year when required.

LILICAR

Y

## VI

LETTER FROM B. A. COLLINS, Esq., C.I.E., I.C.S., DIRECTOR-GENERAL AND SECRETARY TO THE GOVERNMENT OF H. E. H. THE NIZAM, DEPARTMENT OF COMMERCE AND INDUSTRY, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 916, DATED THE 4TH NOVEMBER 1931.

With reference to your letter No. 2209-Agri., dated the 8th of September (not printed), I have the honour to say that there are approximately 80,000 acres under tobacco in His Exalted Highness the Nizam's Dominions. Recently a cigarette company called "The Vazir Sultan Tobacco Company" has been established in His Exalted Highness the Nizam's Dominions, the chief shareholders of which are the Raleigh Company, which is the holding company, in which the Imperial Tobacco Company's interests are represented. The company was established by a special agreement with His Exalted Highness the Nizam's Government who hold one-tenth of the shares and have the right to acquire a further proportion after 20 years on terms already settled. One of the clauses of the agreement between His Exalted Highness the Nizam's Government and the promoters of the company is as follows :--

"The Company undertakes to use in the Hyderabad factory tobacco grown in His Exalted Highness the Nizam's Dominions provided such tobacco is equal in quality and suitability to and does not cost more than tobacco which is available elsewhere."

"The Company further undertakes to procure the services of an expert in leaf tobacco cultivation who will be prepared for a period of two years to experiment within His Exalted Highness the Nizam's Dominions in the cultivation of leaf tobacco and to demonstrate to raiyats or to assist in improved methods of cultivating and curing tobacco suitable for manufacturing cigarettes, provided that His Exalted Highness the Nizam's Department of Agriculture gives such expert every facility and assistance in that behalf."

2. This expert who has had long experience of tobacco cultivation in the Leaf Development Company was appointed in March 1931 and is now engaged in making a preliminary survey of the area at present under tobacco in the State and also in experimenting on the Government farms with small plots of various types of tobacco with a view to testing soil and climate and of demonstrating to our agricultural staff, and through them to the surrounding raiyats different types of tobacco and up-to-date methods of cultivation. Although the first season's work is only just commenced, the results are encouraging, and it is believed that the expert has been able to advise many of the cultivators with benefit to themselves. After the first season, when a preliminary report has been made, it will be considered whether attempts should be made to specialise in any particular branch of the industry.

3. Generally speaking, it seems doubtful whether, if the tobacco expert is to be appointed by or with funds given by the Imperial Council of Agricultural Research, he should be a man who has merely specialised in cigar manufacture. The present problem, as pointed out by the Madras representative, seems to be rather one of cultivation and curing. The import figures show that large quantities of leaf for the manufacture of cigarettes are still being imported from America and there seems no reason why all this tobacco should not be grown in India, and further why India itself should not become an exporting country in



respect of cigarette tobacco. The difficulties which have occurred in the initial stages, to which the Madras representative refers, do not seem a ground for abandoning the attempts to grow our own cigarette tobaccos and to export a better class of tobacco from the country. Any expert appointed should, therefore, rather have a practical knowledge of the cultivation for commercial purposes of all types of tobacco suitable for cigarette and cigar making. The survey which recently appeared in the *Indian Trade Journal* of September the 24th; which purports to have been written by the Council's own Agricultural Expert, seems to support this opinion and it is suggested that if the provinces cannot appoint their own cultivation experts, it might be useful if the Council itself were to appoint such an expert who could place his experience and advice at the disposal of the various provincial departments.

## VII

LETTER FROM S. V. RAMAMURTI, ESQ., I.C.S., SECRETARY TO THE GOVERNMENT OF MADRAS, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 1736-M.S., DATED FORT ST. GEORGE, THE 5TH DECEMBER 1931.

With reference to your letter No. 2209-Agri., dated 8th September 1931 (not printed), I am to enclose a subsidiary scheme of research on tobacco for consideration with the scheme submitted by the Bengal Government.

*Scheme of Research on tobacco.*

I have the honour to state that the Bengal scheme provides for the appointment of a Cigar Curing and Blending Expert whose services will be available for this province also. Though Madras with 260,000 acres leads in the tobacco-growing provinces of the country, for want of staff and money no work of importance has been done here. At Guntur and Koilpatti Agricultural Research Stations the work on tobacco has been confined to varietal and manurial trials.

2. Tobacco in the Presidency is grown for four purposes, namely, for cigar and cigarette smoking, for chewing and snuff. The area under chewing tobacco is the largest and most widespread. Some of the problems that await solution are :—

The influence of soil and irrigation water on the quality of leaf grown for different purposes mentioned above; the methods which should be adopted for curing different types of tobacco; the possibility of growing wrapper tobacco in Madras; the improvement of filler tobacco and methods to be adopted; manurial and cultural tests; importation of exotic tobacco varieties; and improvement of local varieties which would compete with the foreign market and so forth.

3. The business of curing is chiefly in the hands of local curers which leaves much room for improvement. Our knowledge in scientifically dealing with this problem is indeed very limited, so that the curing and blending expert proposed in the scheme will be of great assistance to us. I would suggest that he should concern himself not only with cigar tobacco but with chewing and snuff tobaccos which are of equal, if not of greater, importance to the ryots of the Presidency: for, while large firms are engaged in dealing with the improvement of cigar and cigarette tobacco, nothing is being done to the crude indigenous curing of the two former.

4. The chief tobacco-growing districts in the Presidency and the areas under this crop are—

District.						Average.
Guntur	..	..	..	..	..	65,271
Vizagapatam	..	..	..	..	..	52,898
Coimbatore	..	..	..	..	..	41,264
Madura	..	..	..	..	..	11,939
East Godavari	..	..	..	..	..	11,552
Kurnool	..	..	..	..	..	9,532
West Godavari	..	..	..	..	..	6,087
Kistna	..	..	..	..	..	5,586
Trichinopoly	..	..	..	..	..	4,993
Salem	..	..	..	..	..	4,195
Bellary	..	..	..	..	..	3,932
Anantapur	..	..	..	..	..	3,875

It may be pointed out that not only is the area widespread, the problems in all the districts are not identical. Therefore, the proposed expert should visit different areas and make a detailed survey of different localities. He should, at the same time, get into close touch with growers and curers. To do this efficiently there should be a local officer, a promising upper subordinate, who should work in collaboration with the expert. The cost of such an officer may be estimated thus—

Particulars.	1st year.	2nd year.	3rd year.	4th year.	5th year.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
I. Pay of Establishment—						
1 Assistant (U. S.) on Rs. 150—10—200.	1,800	1,920	2,040	2,160	2,280	10,200
1 Clerk on Rs. 35—35—1½—50—1—60.	420	420	438	456	474	2,208
1 Peon on Rs. 12—18.	144	144	144	144	156	732
Total	2,364	2,484	2,622	2,660	2,910	13,140
II. Travelling Allowance.	1,200	1,200	1,200	1,200	1,200	6,000
III. Contingencies—						
Postage and telegram charges and tour charges.	200	250	250	250	250	1,200
Purchase of furniture (tables, chairs, etc.).	300	..	..	..	..	300
Grand Total Items I to III.	4,064	3,934	4,072	4,210	4,360	20,640

This amount may be added to the cost of the scheme as sent from Bengal.

## VIII

LETTER FROM H. V. R. LENGAR, Esq., I.C.S., UNDER SECRETARY TO THE GOVERNMENT OF BOMBAY, REVENUE DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 7915-A.28, DATED BOMBAY, THE 12TH DECEMBER 1931.

With reference to your letter No. 2209-Agri., dated the 8th September 1931 (not printed), I am directed by the Government of Bombay (Transferred Departments) to forward for your information copies of letters from the Chief Agricultural Officer in Sind and the Director of Agriculture, No. 359-1-D., dated the 30th October 1931, and No. 493-15318, dated the 1st December 1931, and to state that at present there is no scheme of research dealing with the tobacco problems in this Presidency ready for submission to the Council.

COPY OF LETTER FROM THE DIRECTOR OF AGRICULTURE, No. 493-15318, DATED THE 1ST DECEMBER 1931.

With reference to Government endorsement No. 7915-A.28, dated the 23rd September 1931, I have the honour to observe that the Bengal tobacco scheme is a cigar scheme and hence has no direct interest to Bombay, although I consider it represents the type of research which the Imperial Council of Agricultural Research should promote.

In Bombay we have a complicated tobacco problem but I do not propose at present to put forward a research scheme for the consideration of the Imperial Council of Agricultural Research because—

- (a) the world economic crisis has profoundly reacted on the demand for cigarette tobacco, and the trade in India is severely curtailing its activities,
- (b) we have several other schemes on hand which I should like disposed of before proceeding with the case of tobacco.

COPY OF LETTER FROM THE CHIEF AGRICULTURAL OFFICER IN SIND, No. 359-1-D., DATED THE 30TH OCTOBER 1931.

I have the honour to refer to the letter No. 2209-Agri., dated 8th September 1931, and accompaniments (returned herewith), from the Secretary, Imperial Council of Agricultural Research, forwarded to me by the Director of Agriculture, Bombay Presidency, under his endorsement No. 493-12822 of 1931, dated 10th October 1931.

Tobacco cultivation in Sind is restricted to the production of strong, coarse tobacco and the cultivation of fine tobacco leaf for cigar and cigarette manufacture is not carried out. The crop is largely grown in Hala Taluka of Hyderabad District where it is a valuable crop to the cultivators, net return of Rs. 300 to Rs. 400 per acre being obtained. The crop is transplanted late, i.e., in August and requires water till the end of October. Under inundation conditions, this late water is not generally available and hence the crop has not extended in Sind, the area being about 7,000 acres only.

Under the conditions of perennial and assured irrigation supply which will prevail after the opening of the Lloyd Barrage and Canal Systems, this difficulty of late irrigation will largely disappear and there is every possibility that a considerable increase in tobacco cultivation will take place. In addition, it will form

a welcome alternative money crop to cotton and other kharif crops which, at present, do not give much return to the cultivators.

The chief problems in tobacco cultivation in Sind are (i) the improvement of local varieties, (ii) the trial of other types, both foreign and indigenous, and (iii) general improvement of cultural and manurial methods. The question of improved methods of curing and of blending are of secondary importance at present and the appointment of an expert in these branches of tobacco manufacture will not be of any value to Sind in the meantime. I have the honour to state, however, that I would welcome the assistance of the Imperial Council of Agricultural Research in the establishment of a sub-station in Hala Taluka for work on the tobacco crop as it is not possible to undertake special research on this crop with my present staff and equipment.

## IX

LETTER FROM DR. S. S. NEHRU, M.A., PH.D., I.C.S., M.L.C., DEPUTY SECRETARY TO THE GOVERNMENT OF THE UNITED PROVINCES, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No 605-A. [XIIA-256, DATED LUCKNOW, THE 19TH DECEMBER 1931.

With reference to your letter No. 2209-Agri., dated the 8th September 1931 (not printed), I am directed to say that this Government have at present no scheme to be submitted in this connection to the Imperial Council of Agricultural Research.

## X

LETTER FROM A. C. MACNABB, Esq., I.C.S., SENIOR SECRETARY TO THE FINANCIAL COMMISSIONERS, PUNJAB, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 3719-D., DATED LAHORE, THE 30TH DECEMBER 1931.

With reference to the correspondence ending with your telegram No. 3042-Agri., dated 24th December 1931 (not printed), I am directed to forward herewith a copy of a letter No. 87|63|1028, dated the 22nd December 1931, from the Director of Agriculture, Punjab, and to state that the Financial Commissioner, Development, generally agrees with it, but the proposal has not yet been placed before the Punjab Council of Research nor has it yet been approved by the local Government.

COPY OF A LETTER FROM THE DIRECTOR OF AGRICULTURE, PUNJAB, TO THE SENIOR SECRETARY TO THE FINANCIAL COMMISSIONERS, PUNJAB, No. 87|63|1028, DATED THE 22ND DECEMBER 1931.

With reference to the correspondence ending with your endorsement No. 3664-D., dated 19th December 1931, I have the honour to say that climatic conditions in the Punjab do not appear to favour the growth of cigarette and cigar tobaccos. It is, therefore, felt that attention should be concentrated on the coarse varieties for chewing, smoking and snuff and that the following problems should be investigated :—

- (a) Isolation of existing varieties and introduction of new ones from outside.

- (b) Comparative studies of the yield and quality of the important varieties.
- (c) Cultural methods such as topping, spiking, spacing, etc.
- (d) Manurial requirements of tobacco for yield and quality. In some places the cost of sheep manure applied for tobacco growing is said to be as high as Rs. 200 per acre. The use of artificial fertilisers requires investigation.
- (e) Study of the optimum quantity of irrigation water for tobacco. Where water is raised from wells the cost is very high.  
More exact knowledge of the water needs of the crop is necessary.
- (f) Study of different methods of curing. Sometimes defective curing makes all the difference between good and bad quality, other things being similar.
- (g) Possibilities of growing tobacco of high quality for cigarettes and cigar manufacture in the Punjab.

It will be seen from the foregoing points that the main work is largely such as can be done by the Deputy Directors of Agriculture on their experimental farms. At present, however, there is no officer in the Department who has any special knowledge of the tobacco crop, and it would be desirable to send a suitable officer to one of the tobacco-growing provinces to make a special study of the crop. It is, therefore, considered that we might confine our request for assistance from the Imperial Council of Agricultural Research, to the provision of the necessary training of a suitable agricultural graduate, in tobacco growing and curing work. After training he would work under one of the Botanists of the Department.

Papers received with your endorsement No. 2925-D., dated 8th October 1931, are returned herewith.

## XI

TELEGRAM FROM THE CHIEF COMMISSIONER, NORTH-WEST FRONTIER PROVINCE, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 88-Rev., DATED PESHAWAR, THE 4TH JANUARY 1932.

Your telegram 3042-Agri of 24th (not printed). See my 14615-Rev. of 14th November 1931. Position as regards tobacco is same as in case of sugar.

COPY OF LETTER FROM LIEUTENANT-COLONEL M. E. RAE, I.A., REVENUE SECRETARY TO THE CHIEF COMMISSIONER, NORTH-WEST FRONTIER PROVINCE, PESHAWAR, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 14615-Rev., DATED THE 14TH NOVEMBER 1931.

I am directed to acknowledge the receipt of your letter No. 956-Agri., dated the 2nd May 1931, and subsequent reminder No. 1997-Agri., dated the 22nd August 1931, and in reply to say that the question of the staff and constitution of the Agricultural Department in this Province is at present under reconsideration. Hence this Administration is not prepared at the moment to put forward a definite scheme. At the same time various questions connected with sugar are of first importance in this Province and it is hoped that it may be possible to put forward proposals towards the end of the year.

## ENCLOSURE IV.

*Extract from the minutes of the fourth meeting of the Bengal Provincial Agricultural Research Committee held at Calcutta on Saturday, the 7th November 1931.*

(2) The scheme for the appointment of a Cigar Leaf Curing and Blending Expert for India, which was approved at the last meeting, was submitted to the Advisory Board at its meeting in June 1931. The Director of Agriculture read the connected portion of the proceedings of the Advisory Board, and pointed out that, while the Madras Provincial Agricultural Research Committee had recommended the scheme, the Madras representative had not supported the scheme at the Advisory Board. Instead, he had declared that Madras tobacco problems are rather different from those of Bengal. There was also criticism from members apparently unaware that the Bengal scheme was only put up after consultation and discussion with Dr. Shaw, who is in charge of the tobacco curing experiments at Pusa. Investigations at Pusa into cigarette tobacco are a different line of work from those in Bengal and elsewhere into wrapper leaf and filler tobaccos for cigars, also the blending of the latter. In particular, the blending of filler tobacco is of very great importance indeed, if the best results are to be obtained, not only in regard to appearance, but also to aroma.

Ultimately, the Advisory Board decided to postpone a decision in the matter, and to ask other provinces to put up their own schemes, so that all could be considered together, with a view to evolving a co-ordinated scheme. The Director of Agriculture said he had ascertained that Assam and Bihar would support any scheme from Bengal, on the grounds that work done in Bengal would benefit them. The Punjab and Madras will put up their own schemes, and probably also the United Provinces and Bombay. There will, therefore, be ample material for discussion and correlation at the next meeting of the Advisory Board.

It appears that as regards work on cheroot tobaccos, Bengal is probably more advanced than other provinces and that, if sound advice be available, it might at an early date supply a considerable proportion of the wrapper leaf required by Southern India, which is at present imported from abroad. Southern India could of course take advantage of the results of such work if they desire to develop their own wrapper leaf supply. Moreover, investigation into cigar filler tobaccos would supply information as to which tobaccos should be grown for the purpose, and this information would also be available to other provinces requiring it. The Bengal proposal therefore has real all-India significance, and could safely be supported on this ground.

The Committee strongly recommended the scheme to the Advisory Board.

## ENCLOSURE V.

**COPY OF NOTE BY THE AGRICULTURE EXPERT TO THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.**

The replies to the Council's enquiry from Local Governments may be summarised as follows :—

*Assam.*—Tobacco cultivation is relatively unimportant and they have no proposals.

Central Provinces.—In this province also tobacco is relatively unimportant and they have no proposals.

*Burma.*—The present area under tobacco is about 100,000 acres but, unlike some provinces, the possibilities of expansion are very limited. The Burma Government are a little doubtful of the possibility of tackling the improvement of cigars through an expert in a Government Department and suggest inviting the opinions of large tobacco firms in India.

*The Mysore State* has no scheme to propose.

*The Government of Bihar and Orissa* have no scheme of their own to put forward but are in full sympathy with the scheme for Bengal and Madras. The scheme would be of help to them and they would like the expert to be available to assist the Bihar Department also.

*Hyderabad State.*—This State has 80,000 acres under tobacco and considerable progress is being made in the development of improved tobacco for cigarette making. The recently established Company employs an expert who has already rendered much assistance. They consider that a cultivating expert rather than a cigar curing expert is required.

*Madras.*—The Madras Government support the Bengal scheme and submit a subsidiary scheme to enable Madras to co-operate more fully. They point out that the area under tobacco in Madras is the largest in any province in India, viz., 260,000 acres. If the proposed expert should also take up the question of snuff and chewing tobacco, it would be an advantage. The essence of the proposed subsidiary scheme is that an upper grade Agricultural Assistant should be provided to work in collaboration with the expert. The estimated cost is approximately Rs. 4,000 per annum.

*Bombay Government.*—The Bombay Presidency is not interested in cigar tobaccos and therefore the proposed scheme would not have any direct application to Bombay conditions. Nevertheless, they consider that this is a type of research which the Council should promote. Bombay has a complicated tobacco problem of its own, mainly economic and connected with the slump in the cigarette trade, but they do not make any proposals for research at present.

*Sind.*—The Chief Agricultural Officer replies that Sind is mainly concerned with coarse tobaccos at present and that meantime curing and blending are relatively unimportant compared to varietal and cultivation problems in relation to the new supply of perennial irrigation. He says that the assistance of the Council towards the establishment of a sub-station for tobacco research in Sind would be welcomed but no scheme is put forward.

*The United Provinces Government* have no scheme to put forward.

*The Punjab Government* have not yet referred the matter to the Provincial Research Committee but their provisional views are that in the Punjab coarse tobacco for chewing, smoking and snuff is most important and the main problems are cultural. But the possibility of growing finer tobaccos requires investigation and there is scope for improvement in tobacco curing. The assistance of the Imperial Council of Agricultural Research is requested in securing the training of an agricultural graduate in tobacco growing and curing. No further details are presented but the cost clearly would not be great as, if the proposed expert is appointed, the graduate assistant selected could do the necessary work on tobacco growing and the curing of cigarette tobacco at Pusa and the remainder under the new expert.

2. From the proceedings it appears that the discussion in the Advisory Board was somewhat diffuse and ranged over a great deal of ground. This is not surprising. At any rate, there is no lack of agreement that improvement in tobacco

cultivation and in the returns to the grower would be of great economic benefit to the country, for tobacco is a crop which gives a high return for the labour expended on it, demands a good deal of labour and demands a high standard of cultivation.

3. The earlier demi-official correspondence with various Directors of Agriculture, the material collected by Mr. Milne for his note on tobacco cultivation and the further replies now received, lead to the following conclusions. Tobacco is cultivated in India for the following purposes :—

- (1) cigarette manufacture ;
- (2) cigar manufacture ;
- (3) export for the production of pipe tobacco ;
- (4) the production of hookah tobacco ;
- (5) the production of chewing tobacco for Indian consumption, and
- (6) the production of snuff.

(1) In regard to cigarette tobaccos, very great progress has already been made and the experimental work carried out at Pusa has led to the production of improved types of cigarette tobacco suitable to Indian conditions, whilst the problem of flue-curing has been worked out. In several provinces and States also very real progress has been made with the growing of superior grades of tobacco for cigarette manufacture and marketing and in the requisite commercial organisation for curing. It may fairly be said that this section of the work is developing satisfactorily.

(2) *Cigars*.—The scheme before us deals essentially with cigar tobacco and it must be recognised that the improvement of tobacco growing and curing for the production of cigars must be dealt with on quite different lines to the production of tobacco for other purposes. It is impossible to divorce the growing and curing side of the problem. There is an established cigar industry which meets both the local demand and an export trade. The potential returns to the grower are large.

(3) *Pipe tobaccos*.—The consumption in India of pipe tobacco of the European type is relatively small. The existence of Imperial preference amounting to s. 2|6 per lb. on imports into Great Britain should foster the trade but temporarily there seems to be an oversupply of Empire *pipe* tobaccos of medium quality. In any case, the tobacco breeding work done at Pusa has resulted in suitable types for this purpose becoming available, so that the fundamental material is ready for agricultural departments who wish to take the matter further.

(4) *Hookah tobacco*.—This probably represents the largest outlay for the Indian tobacco crop. The agricultural problems are mainly those relating to yield rather than quality. The possibility of improved methods of curing has been indicated in the Punjab subsidiary scheme and is a point for consideration when the main scheme goes through.

(5) and (6) *Snuff and chewing tobacco*.—The last remark applies to the point raised by Madras, *viz.*, the quality of chewing tobacco and snuff. It seems not unlikely that if the general principles of successful curing, which have been worked out in other parts of the world, were adapted to Indian conditions that improvement here would be forthcoming.

4. The scheme put forward by Bengal has the definite support of several other of the principal tobacco-growing provinces, especially of Madras and Bihar. It is essentially a scheme for work on cigars but is capable of a certain amount



of development. It is now made very clear that the proposal is to develop work which has already proved successful and to enable India to produce for itself the high class wrapper leaf at present imported from abroad.

5. The cost of the scheme is about Rs. 23,000 per annum and the total cost including small non-recurring expenditure about Rs. 1,20,164. If the Madras subsidiary scheme be added, the whole cost would be Rs. 1,40,804 spread over five years. One criticism made in the Advisory Board at its last meeting has not yet been met, *viz.*, the proposal to station the Expert at Calcutta. It is for consideration whether it would not be better to station him at some such place as Rangpur, where he would be in close contact with the growing side. The question of his being stationed at Pusa was discussed at the last meeting of the Advisory Board but, apart from the objection made by Dr. Keen, Pusa does not seem to be the most suitable place for the work in progress there is essentially concerned with cigarette tobaccos, whilst the railway communications of Pusa are far from good.

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ENCLOSURE VI.

**INFORMATION ON TOBACCO INDUSTRY IN THE PROVINCES.**

DEMI-OFFICIAL LETTER TO THE DIRECTORS OF AGRICULTURE, BENGAL, BIHAR AND ORISSA AND BOMBAY, NO. 1345|AGRI., DATED THE 20<sup>TH</sup> JUNE 1931.

I am asked to write a note on tobacco with a short description of its history and present agricultural, technical and economic position, referring also to marketing. Could you help me in this by giving me information on the following points:—

1. The main varieties of tobacco grown in your province stating whether they belong to *Nicotiana Tabacum* or *Nicotiana rustica* and giving roughly areas of these grown and their uses, *i.e.*, whether they are made into cigarettes, cigars (a) fillers, (b) wrappers, snuff, etc.
2. Kindly name the chief tracts in which tobacco is grown in your province. Is it correct to say that these are for Bengal|Bihar and Orissa|Bombay|the Rangpur tracts of Bengal|Bihar districts of Bihar|Gujrat tracts in Bombay.
3. What are the dates of (a) sowing tobacco seed, (b) transplanting seedling, and (c) harvesting the crop.
4. Give a brief outline of the methods of curing leaf.
5. Outturn per acre of cured leaves.
6. An indication of the importance of the business of making cigarettes, cigars, snuff, etc., by filling up a statement showing—

Situation of each factory.	Kind of products turned out— cigarettes, cigars, snuff, etc.	Quantity of manufactured produce turned out per annum.	Approximate number of workers employed.

and any other information of interest regarding these factories. Also general remarks regarding the approximate amount of cigarettes, cigars, snuff, etc., made as cottage industries.

7. I have got export and import figures of tobacco from "Seaborne Trade Accounts" but would be glad of any other information which you may think of interest which is not given in that publication.

8. A brief note on any points of interest regarding marketing.

9. General remarks on whether the cultivator regards tobacco as a very paying crop.

10. A brief note on what you have done for the improvement of the tobacco trade in the province mentioning any successes you have had in introducing of breeding new varieties of tobacco, improving methods of cultivation, curing leaf, etc. Also kindly note on the prospects of developing the tobacco trade there.

11. One or two photos to illustrate the article would be very acceptable.

I would be further indebted if you could treat this matter as very urgent as I see that I am expected to have this article ready in early July. In the hurry of work with the Governing Body, the Oilseeds Committee and the Advisory Board it has apparently been overlooked. With many apologies for troubling you. All good wishes.

DEMI-OFFICIAL CIRCULAR LETTER FROM MR. D. MILNE, C.I.E., ACTING AGRICULTURAL EXPERT, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, TO THE DIRECTORS OF INDUSTRIES, BOMBAY, BENGAL, MADRAS, BURMA AND BIHAR AND ORISSA, NO. 1485/AGRI., DATED THE 3RD JULY 1931.

I am asked to write a note on tobacco with a short description of its history and present agricultural, technical and economic position referring also to marketing. Could you help me in this by giving me—

(1) An indication of the importance of the business of making cigarettes, cigars, snuff, etc., in your province by filling up the following statement :—

- (a) name and situation of each factory,
- (b) whether the factory is power-driven or not,
- (c) kind of products turned out, i.e., cigarettes, cigars, snuff, etc.
- (d) quantity of manufactured produce turned out per annum; also approximate weight,
- (e) approximate number of workers employed,
- (f) any other information of interest regarding these factories.

(2) General remarks regarding the approximate amount of cigarettes, cigars, snuff, etc., made as cottage industry.

(3) Any information as to whether there has been an increase in the amount of cigarettes, cigars, snuff, etc., made in your province in the past 10 years.

(4) Any information of interest regarding whether the tobacco leaf used is *desi* or foreign or a mixture.

(5) Any points of interest regarding marketing of the produce.

I am asked to send in this note very urgently and would therefore be very grateful if you could send me any information available as early as possible.

With many apologies for troubling you.

DEMI-OFFICIAL LETTER FROM MR. G. S. HENDERSON, DIRECTOR OF AGRICULTURE, BIHAR AND ORISSA, TO MR. D. MILNE, C.I.E., AGRICULTURAL EXPERT, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. 6681, DATED PATNA, THE 26TH JUNE 1931.

Reference your letter dated the 20th June regarding Tobacco. I may state generally that this province is dependent on Pusa for the work of Botanical improvement on Tobacco. Dr. Shaw has recently taken up research work on Cigarette Tobacco and the information supplied by Pusa will refer to this Province. There are two main blocks of Tobacco cultivation in this Province. The one of outstanding importance is in Muzaffarpur and Darbhanga districts, where there is a compact block of 70,000 acres. The second large area is in Purnea district, where there is about 46,000 acres. This is closely connected with the tobacco area in North-West Bengal, the centre of which cultivation is at Rangpur in Bengal. The information given to you by the Bengal Department regarding area will apply actually in all respects to this Purnea tract. It is simply an outlying part of Rangpur area and the produce is brought up by Bengalis.

In the Tirhut Division the variety is *Nicotiana Tabacum*. It is very largely bought up by merchants from Calcutta and sometimes by merchants from Bombay side. It is used for *Hooka*, *Beeri* and the poorer quality for snuff.

The dates of sowing tobacco seed vary to a certain extent with the monsoon. September is said to be the general month for sowing seed. Transplanting is done in October and November depending considerably on the monsoon conditions. The harvesting takes place about March-April.

The leaves are tied in hands. They are fermented in heaps on the ground for varying periods according to purposes required and they are then well dried. The outturn per acre of cured leaves may run up to 15 maunds per acre.

The Imperial Tobacco Company have got large factories at Dalsingsarai in Tirhut and at Monghyr, south of the river. They use large quantities of imported tobacco to produce a wide range of different quality cigarettes. You might apply to them direct for detailed information.

The Muzaffarpur-Darbhanga (Tirhut) area is largely in the hands of the cultivating caste known as *Kaeries*. They specialise in tobacco cultivation and their technique is especially good. I have not seen tobacco cultivation in any part of India so well cultivated as is done by these *Kaeries*. The plants are gone over individually all axillary shoots and adventitious leaves are carefully nipped off. The *Kaeries* grow tobacco without irrigation and the land is very carefully cultivated and a very good tilth is prepared. All cultivation is done by hand. Very heavy manuring is resorted to and "seeth", i.e., refuse from indigo vats is very highly valued. A hundred load of seeth per acre on suitable high tobacco land will cause that land to be valued at a sum round about Rs. 100 per acre as rent for a single season for tobacco.

Tobacco is considered as a specialised crop and generally is confined to *Kaeri* cultivators and so its extension is unlikely to any large extent as the capital involved in the cultivation is too large for the ordinary cultivator.

The work of this Department in addition to introducing the results of research at Pusa consist up to date in manurial and cultural experiments. It is hoped to be able to produce tobacco economically by using bullock labour in cultivation instead of doing only by hand.

I regret I have no photographs, but there is a large collection available at Pusa.

NOTE ON TOBACCO BY MR. KASHI RAM, ASSISTANT IN CHARGE OF THE EXPERIMENT AT THE BOTANICAL SECTION, PUSA, RECEIVED WITH DR. KEEN'S SEMI-OFFICIAL LETTER NO. 4882, DATED THE 30TH JUNE 1931.

It seems to be a fact that tobacco was introduced into India by the Portuguese, in the days of their adventurous career, as a worthy present to the Grand Mogul Court of India in the year 1605 A. D. Ever since its introduction it has been gaining popularity till the present day. India is the second largest tobacco growing country in the world. The relative importance of the provinces in the production of the crop is given in the table below :—

*Area under crop in acres for 1929-30.*

Madras	..	..	..	..	257,000
Bombay (including Sind)	..	..	..	..	161,000
Bengal	..	..	..	..	295,000
United Provinces	..	..	..	..	101,000
Punjab	..	..	..	..	59,000
Burma	..	..	..	..	117,000
Bihar and Orissa	..	..	..	..	142,000
Central Provinces	..	..	..	..	114,000
Assam	..	..	..	..	10,000
North-West Frontier Province	..	..	..	..	10,000
Delhi	..	..	..	..	1,000
Mysore	..	..	..	..	22,000
Baroda	..	..	..	..	45,000
Hyderabad	..	..	..	..	81,000

There are two principal species of tobacco cultivated in India, viz., *Nicotiana tabacum*, L. and *Nicotiana rustica*, L. The former is the common pink-flowered tobacco of India, being grown all over the country. It is apparently the chief species cultivated in the Peninsula and forms the most important source of the tobacco of commerce. The latter, viz., the yellow-flowered tobacco is widely cultivated in Eastern Bengal, Assam, the United Provinces, the Punjab and also in Kashmir. This species is hardier, requires a shorter time to come to maturity. Therefore it suits very well in the damper soils of inundated areas of Bengal

and also in the Punjab and the United Provinces where the crop is generally grown as a late cold weather or early spring crop. It is also said to give a higher yield than *N. tabacum* as the leaves are stalked and that these are not separated from the stems. In the agricultural statistics the two species are not classified separately.

From the figures of Table I it is clear that Tobacco is one of the most valuable crops grown in India, the estimated acreage being about one million acres and the annual value of the crop being placed at about ten to fifteen crores of rupees.

In spite of the large production of tobacco in India, this country does not take a proportionate share of the international export trade in tobacco. The leaf produced in India is generally of a coarse heavy type with a dark colour and strong flavour; as such, it suits the local market and the bulk of the crop is consumed in the country.

Previous attempts to improve the quality of Indian leaf tobacco for export purposes have not met with much success. In 1874 experiments were carried out at Pusa on a commercial scale with many foreign varieties of tobacco. In 1887 curing experiments were tried at Nadiad, and in 1891 work was done in Madras where a professional tobacco curer was engaged by the Madras Government. Another attempt was made in Bihar at Dalsingsarai. None of these early efforts were successful.

In recent years the principal feature of the leaf tobacco trade has been the large and still increasing demand for the cigarette type of tobacco. The most important qualities in a good cigarette tobacco are a light yellow colour, a mild flavour, good burning qualities and a certain elasticity in the cut tobacco. Colour is perhaps the most important factor, since flavour is, generally, closely related to it. A light yellow or "bright" tobacco may possess a flavour which makes it suitable for use as a cigarette tobacco but a dark leaf is practically always a strong and coarse flavoured smoke, suitable for pipe and *biris* but useless for cigarettes. Burning qualities are next in importance and a cigarette tobacco must burn easily and not give a hot smoke. Elasticity depends largely on the capacity of the cut tobacco to retain a certain amount of moisture; without this property the tobacco in a cigarette will dry to powder and fall out leaving an empty paper cylinder.

In order to produce such a high grade tobacco in India by (a) Rack-curing, (b) Flue-curing, and (c) Hybridization has been the subject of experiments at Pusa for the last 5 or 6 years.

(a) *Rack-curing*.—The rack-curing in Bihar gave a light brown leaf which was by no means of the quality which is required for a good cigarette tobacco.

(b) *Flue-curing*.—The researches at Pusa have shown that a cigarette tobacco of quality superior to any produced in India heretofore can be obtained by flue-curing in a specially constructed barn. Samples of the leaf cured at Pusa were sent to experts in England for valuation. They gave it as their opinion that the samples were the best they had seen so far of Indian growth, and that they resembled the corresponding American type. (For details please see Agricultural Research Institute, Pusa, Bulletin No. 187). But the marketing of flue-cured tobacco in India is subject to a limitation which perhaps does not exist in the case of any other agricultural product. After curing the tobacco must be passed

through redrying machines in order that it may contain a definite percentage of moisture. These machines are large and expensive and only few exist in India; the sole market for flue-cured tobacco, therefore, is with the commercial organisation which maintains such machines in India. The first result of the development of this branch of tobacco trade would be the replacement, in part, of imports of foreign leaf, chiefly from the United States of America, by the Indian grown product. Surplus production beyond the demand of the Indian market would be available for export to the United Kingdom where the preferential tariff on Empire tobaccos accords a favourable position to all leaf grown within the British Empire.

As a result of the researches at Pusa several hundred flue-curing barns have been erected in Bihar, United Provinces and Madras. More recently the general trade depressions have set back this trade to an enormous extent.

(c) *Hybridization*.—One of the best cigarette tobaccos grown in the United States of America is that known as Adcock. This variety grows and cures well in America and forms the basis of some of the most popular brands of "Virginian" cigarettes in the world. This was introduced into India on a large scale by a commercial organisation.

Adcock though a leaf of quality is comparatively delicate and low yielding than an indigenous type. Hence it appeared advantageous to search for a type which would combine the curing qualities of Adcock with the hardiness yielding power and quick growth of an indigenous type. Keeping this in view a cross was made between Adcock and Pusa Type 28. As a result to this about 10 promising hybrids breeding pure within narrow limits like the original parents have been produced. (Studies in Tobaccos, No. 6, in press). The work of testing the quality of the leaf of each of the newly produced hybrids is still in progress.

In addition to this the studies of the various types cultivated in the country were carried out (Memo. Dept. Agri. Bot. Ser. Vol. III, Nos. 1 and 2).

Moreover, in order to suit the local trade demands seeds of the indigenous type 28 of *N. tabacum* and type 18 of *N. rustica* have been extensively distributed.

*Work on Tobacco in places other than Pusa*.—The acclimatization of exotic cigar and cigarette tobacco and the improvement of the local races by selection are in progress at Burirhat in Bengal. The cigar varieties imported from Sumatra and Manila and grown on the farm have shown that cheroot tobacco of quite high quality can be produced in Bengal. The departmental selection *Motihari* which has acquired the reputation of being the best *Hooka* tobacco in the province, is now being grown in tracts which have not hitherto grown tobacco on large scale. The superiority of *Motihari* over the local varieties is recognised in Assam too, and its cultivation is gaining ground. The other varieties under trial in this province are the Rangpore, *Bhengi* and Pusa Type 28. The last mentioned variety has proved a definite success in North Bihar, and a scheme for distribution of seed on a larger scale is under consideration. Among the cigar varieties collected at Sa-aing in Burma, Pennsylvania promises to prove the most suitable for general cultivation. It produces a good wrapper tobacco, when coarser grown, it has a flavour suitable for filling. *Gandiu* No. 6 has established itself in the Upper Gujrat districts of Bombay. The high prices realized for the 1926-27 crop has given a great impetus to the cultivation of Virginian variety (Adcock) in the Guntur District of Madras, and the area under it is now estimated at 25,000 acres.

Statement showing area under Tobacco in Indian States during the years 1928-29 and 1929-30, received with Dr. Meek's demi-official letter No. 5796, dated the 30th June 1931.

States.	1928-29.	1929-30.
	Acres.	Acres.
Hyderabad .. .. .	103,284	(a) 80,680
Mysore .. .. .	27,593	23,692
Baroda .. .. .	38,172	44,925
Gwalior .. .. .	5,300	8,464
Kashmir .. .. .	4,366	(b)
Madras States .. .. .	104	102
Bombay States .. .. .	489	(c) 192
United Provinces States .. .. .	3,752	4,115
Punjab States .. .. .	698	848
Punjab Agency States .. .. .	6,060	7,988
Central India States .. .. .	8,500	9,846
Rajputana States .. .. .	10,875	15,931
Total .. .. .	209,193	(c) 196,783

(a) Forecast figure and therefore subject to revision. (b) Not yet available. (c) Incomplete.

DEMI-OFFICIAL LETTER FROM MR. A. MCKERRAL, DIRECTOR OF AGRICULTURE, BURMA, TO MR. D. MILNE, AGRICULTURAL EXPERT, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. 5483|IA-10|Pt.|XIV, DATED THE 30TH JUNE 1931.

Reference your D. O. letter of 19th June 1931, asking for information in regard to the tobacco crop. I shall try to answer your queries shortly.

- (1) Regarding varieties the Agricultural Department in past years distributed large quantities of Virginian and Havana seed but it is impossible to state the areas under each kind. Most of the tobacco now grown in Burma is derived from this distributed seed. There is one factory for making cigarettes in Rangoon. Burmese cheroots are made in many places as a cottage industry. There is no trade

for fillers so far as I know. Tobacco as snuff is not used by the Burmese people. The statement regarding varieties is correct.

- (2) The main tobacco growing tract is along the river Irrawaddy on land which is submerged during the rains. There is no inland cultivation such as one sees in Bihar.
- (3) Tobacco seed is sown in September and October and transplanting is done in December and January. Harvesting of the crop is in April and May.
- (4) There are three systems of curing producing three types of tobacco as follows :—
  - (a) *Da-li-hse*—chopped or shredded tobacco used mainly for pipe-smoking.
  - (b) *Kat-hse*—which is used with chopped tobacco for the making of Burmese cheroots.
  - (c) *E-hse*—which is used for making the exported Burmese cheroot.

In making *Da-li-hse*, the tobacco is shredded with a knife as it is brought in from the field and dried in the sun for two or three days in heaps, which are moistened from time to time and then packed tightly in wicker baskets.

In making *Kat-hse* latticed squares of split bamboo are laid on the ground in the sun and tobacco leaves are spread on them. A second bamboo square is then put on the top of the leaves. The tobacco is left like this for three or four days until the mid-rib is dried when the leaves are collected and placed one on top of the other.

In making *E-hse* the leaves are threaded through the bottom of their mid-ribs on to a thin strip of bamboo on which they are hung up in a shed. This is shade curing and gives the best type of tobacco.

(5) Outturn per acre of cured leaves varies from 400 to 1,000 lbs. per acre.

(6) I regret that I cannot give the exact information under this head. There is one cigarette factory in Rangoon and there are large numbers of "cheroot factories" so called all over the country. In the latter no machinery is used, hand rolling only being resorted to.

(7) The total area under tobacco in Burma is about 100,000 acres the export being largely to the Straits and China. The export is about Rupees 20 lakhs in value but the import of raw tobacco is more than double this amount. The imports are mainly from Bengal and Madras.

(8) There is nothing particular about the method of marketing. The large buyers in Rangoon send up brokers who would do the buying on the spot from the actual cultivators or from local brokers as in the case of other crops.

(9) Tobacco is not regarded in Burma as a very paying crop especially at present prices. These have fallen by half during the last year.

(10) As explained above most of tobacco now grown in Burma is derived from exotic varieties introduced by the Agricultural Department. There is a small farm of ten acres run as an annex to the Central Farm at Allamyo which deals with tobacco problems. We are testing varieties of tobacco and working out methods of curing with a view to the improvement of the cheroot and to getting a type of tobacco suitable for cigarette making.



(11) I regret that I have no photographs in the office but I shall ask Odell if he has had any. His address is—F. D. Odell, Deputy Director of Agriculture, West Central Circle, Magwe, Burma and it would probably save time if you also write to him direct.

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NOTE RECEIVED FROM THE ASSISTANT DIRECTOR OF AGRICULTURE, BENGAL, RAMNA, DACCA, WITH HIS DEMI-OFFICIAL LETTER No. 10946, DATED THE 7TH JULY 1931.

1. The main varieties of Tobacco grown in the Province are :—

N. Tabacum "Bhengi" and "Naokhol" and "Hingli".

N. Rustica "Belait" or "Motihari".

The finer qualities of *Bhengi* are shipped to Burma. Some of this is used for the ordinary Burma cheroot but most of it is used for the Burmese "torch".

Poorer qualities of *Bhengi* are purchased by cigarette manufacturers.

*Naokhol* has a market in the Maldives.

*Hingli* grown in Central Bengal and is chiefly consumed as snuff.

*Motihari* is mainly used for hookah tobacco and a certain quantity is used for snuff.

The types introduced by this Department are—Sumatra wrapper tobacco and Burmese Havana, Manilla and Pennsylvania filler tobaccos.

The area under these in the present year will be—500 acres.

Of the 200,000 acres under tobacco in Bengal 150,000 are under *N. tabacum*. The cultivation of *N. rustica* has been largely extended throughout the Presidency by Departmental propaganda persuading cultivators to grow sufficient for their own use.

2. The main tract is in the Districts of Jalpaiguri and Rangpur and the Cooch Behar State.

The Hingli tract which is of lesser importance lies in the Murshidabad, Nadia and Jessore districts in Central Bengal.

3. (a) August—September.

(b) October—December.

(c) March—April.

4. Whole plants are cut not individual leaves—when the dew has dried off in the morning. These are left to dry in the sun for one to two hours and then carried to the drying shed which may or may not be a special erection. As a rule cattle shed and outhouses serve as a drying shed. The plants are slung on bamboos, head downwards, a foot or so apart. The process takes about three weeks. The leaves are then stripped from the main stalk and placed flat in heaps stem inwards to ferment. The heaps are closely watched to prevent over heating being turned periodically. Fermentation takes about two months. The heaps are then opened out and the leaf made into "bands" each "band" containing 20 to 30 leaves of the same size, as far as possible.

The tobacco is either sold in this state or kept in heaps to mature.

5. 9-12 maunds of cured leaf.

6. It is not possible to give definite figures without investigation.

A number of factories were in existence, some years ago, but were crowded out by the powerful combine.

Recently, with the Swadeshi movement, several companies have been promoted but it is very difficult to obtain information as to their activities.

7. From tobacco journals it appears that the exports of tobacco from India are much less during the current year. This may be due to the general trade depression but it is also due to the fact that consumption of cigarettes has fallen in India. A considerable quantity of Indian tobacco returned manufactured into cigarettes. Another reason may be, that Colonial growers objected to Indian tobacco being blended with their product and marketed as "Empire" tobacco, thereby lowering the quality.

8. Burma is the main consumer of Bengal tobacco. Burmese or Magh merchants purchase in the Rangpur tract through "dalals", seldom direct. The "Dalals" provide the godown accommodation and purchase on commission. They are also responsible for the sorting and grading and providing the labour. Many of the "Dalals" themselves cultivate tobacco. Unlike jute, the marketing of tobacco is comparatively free from middlemen.

9. Tobacco is undoubtedly a paying crop in the Rangpur tract. At present prices it is not remunerative but with Burmese paying Rs. 15 to Rs. 20 per maund it certainly is.

The firm which is purchasing the cigar tobaccos introduced by Department pay—

A grade Rs. 40 per maund.

B grade Rs. 25 per maund.

C grade Rs. 15 per maund.

D grade Rs. 8 per maund.

as against the present rate for country tobacco of Rs. 10.

The average rate they paid last year was Rs. 22 per maund, but this year's rates are probably higher as cultivators have begun to realise that care in handling pays.

One of the difficulties as regards quality jute is the low premium offered by the trade for quality, 8 annas or less between marks, and this department impressed upon the company purchasing tobacco the necessity of paying adequately for quality.

10. This Department opened a farm in the Rangpur Tobacco Tract in 1907.

The lines of research were—

(a) Improvement of local tobaccos by selection.

(b) Investigation into the possibilities of introducing—

(i) Exotic cigar tobacco

(ii) Virginia tobacco

(iii) Turkish tobacco

(c) Manurial and cultivation—

(a) Selected races of *Bhengi*, *Motihari* and *Naokhol* are now grown throughout the tobacco tract.

- (h) (i) Sumatra wrapper leaf has proved very successful, the quality being very high indeed. Filler tobaccos were more difficult as owing to the light soil there was a lack of body and aroma although the burning qualities were good. Burmese Havana, Pennsylvania and Manilla are now being grown on heavier soil and have proved successful.
- (ii) The production of Virginia tobacco—White Burley being the most successful—was continued up to 1915, excellent quality being produced by flue-curing. The prices received for the leaf, there being no export at the time, were not commensurate with the cost and the work was closed down until 1920. Since then excellent samples have been obtained but the question of the economic value of producing flue-cured Virginia tobacco in Bengal has still to be decided.
- (iii) Turkish tobaccos did not maintain their flavour in Bengal.
- (c) Green manuring has been introduced on an extensive scale through the Department.

The use of fertilisers is extending.

LETTER FROM P. B. ADVANT, ESQ., DIRECTOR OF INDUSTRIES, BOMBAY, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, S. W., No. I. B. 150/4238, DATED THE 9TH JULY 1931.

With reference to your Circular D. O. No. 1485/Agri. dated the 3rd July 1931 and the information asked for therein I have to reply *ad seriatim* as follows :—

- (1) (a) S. Mars & Co., Santa Cruz, Bombay Island.  
 Khedival Tobacco Co., Andheri, Bombay Island.  
 D. Macropolo & Co., Bombay.  
 Asian Tobacco Co., Andheri, Bombay Island.  
 Crown Tobacco Co., Bandra, Bombay Island.  
 Firehand Tobacco Co., Andheri, Bombay Island.  
 Upper Sind Cigarette Mfg. Co., Sukkur, Sind.
- (b) Factories work only part of their machinery with power, the cigarettes being mostly manufactured by hand.
- (c) Cigarettes.—There are small factories making snuff but no reliable information is available.
- (d) 11,30,000 cigarettes weighing approximately 27,000 lbs.
- (e) 370 workmen.
- (f) Out of the seven cigarette factories only two factories have automatic cigarette making and printing machines. The rest of the factories have only tobacco cutting machines. All the other work is done by hand.
- (2) Figures not available.
- (3) There were only three cigarette factories until 1923. Since then these have been increased to seven on account of the present Swadeshi movement.

- (4) Out of the seven factories, two cigarette factories import a small quantity of Turkish and Virginia (Carolina) tobacco for the manufacture of special class of cigarettes as well as for blending purposes. The rest of the cigarette factories utilise mostly the Guntur quality of Indian (Virginia) tobacco using also small quantities of Gujarat and Nipani tobacco for cheap quality blending.
- (5) Cigarettes are sold to local dealers either wholesale or retailed to petty dealers. Cigarettes are consumed in the Presidency and also sent to different parts of India.

*Statement showing information regarding Bidi, snuff establishments in the Bombay Presidency.*

No. of Bidi and snuff establishment as cottage industry.	Average number of persons employed daily.	Approximate quantity of bidi or snuff turned out per annum in maunds.	Tobacco used whether indigenous or foreign.
Bidis .. .. 389	13,377	213,247	Indigenous.
Snuff .. .. 9	56	4,073	Ditto.

The output of Bidis and snuff on the whole show an increase in consumption.

*Statement showing Bidi and Snuff establishments in the Bombay Presidency.*

No. of Bidi and Snuff Establishments. Cottage industry.	Average No. of persons employed daily.	Approximate quantity of Bidi and Snuff turned out per annum in maunds.	Whether tobacco used is indigenous or foreign.	Remarks.
609 (Bidi) ..	13,359	41,484	Indigenous ..	The output of Bidi and Snuff show an increase of consumption.
7 (Snuff) ..	250	4,781	Do. ..	

NOTE RECEIVED FROM RAO RAHADUR D. ANANDA RAO, B. Sc., OFFICIATING DIRECTOR OF AGRICULTURE, MADRAS, WITH HIS DEMI-OFFICIAL LETTER No. D-1034-31, DATED THE 8TH JULY 1931.

In the Madras Presidency, according to the Season and Crop Report for 1929-30, out of the area of crops cultivated (39,259,253 acres) tobacco occupied 256,703 acres, i.e., about 6.5 per cent.

2. The area of tobacco in various districts comprising the Presidency in 1929-30 is indicated below :—

	Acres.				
Guntur .. .. .	..	..	..	..	1,00,606
Vizagapatam .. .. .	..	..	..	..	52,449
Coimbatore .. .. .	..	..	..	..	33,402
East Godavari .. .. .	..	..	..	..	12,112
Madura .. .. .	..	..	..	..	10,669
West-Godavari .. .. .	..	..	..	..	6,545
Kistna .. .. .	..	..	..	..	5,881
Salem .. .. .	..	..	..	..	4,943
Kurnool .. .. .	..	..	..	..	4,082
Trichinopoly .. .. .	..	..	..	..	3,439
Ramnad .. .. .	..	..	..	..	2,813
Ganjam .. .. .	..	..	..	..	2,632
Nellore .. .. .	..	..	..	..	2,583
Bellary .. .. .	..	..	..	..	2,544
North Arcot .. .. .	..	..	..	..	2,234
Anantapur .. .. .	..	..	..	..	2,162
South Arcot .. .. .	..	..	..	..	1,726
Tanjore .. .. .	..	..	..	..	1,612
South Kanara .. .. .	..	..	..	..	1,439
Tinnevelly .. .. .	..	..	..	..	1,280
Cuddapah .. .. .	..	..	..	..	949
Chittoor .. .. .	..	..	..	..	497
Malabar .. .. .	..	..	..	..	47
Chingleput .. .. .	..	..	..	..	32
The Nilgiris .. .. .	..	..	..	..	25
					2,56,703

Normal yield in the case of dry crop varies from 800 to 1,000 lb. dry leaf per acre and up to 1,500 with irrigated crop. The main variety grown in the Presidency is *Nicotiana tabacum*. Adcock and white burley varieties for Cigarette manufacture are grown to some extent only in the Guntur district.

3. The importance of the crop in each district of the Presidency is detailed below :—

The most important tobacco growing centre in the Presidency is Guntur district. Here the crop is grown dry and the leaf is in consequence lighter and it

can be used for the manufacture of cigarettes and is mostly exported to foreign countries for that purpose. The industry is largely controlled by the American leaf company. In a few places cigar tobacco is grown and it fetches a premium. Tobacco is cultivated on a commercial scale in the *lankas* (deltaic islands) of the Kistna and in the black soil areas. There is considerable export trade to Burma, Dindigul and foreign countries.

The firms interested in the purchase of leaf for cigar and cigarette manufacture make their own arrangements with the ryots for the growing of the variety of tobacco they require. They do not like the Department to issue seeds for obvious reasons. They seem to fear that ryots would grow in the localities from which best results may not be obtained.

Vizagapatam District is the second largest producer of tobacco in the Presidency. A large portion is consumed locally and in addition a considerable amount of cheroot leaf comes into the District from Godavari and Kistna districts and Hyderabad State.

In the Godavari district, production exceeds local requirement. Ganjam district imports leaf from Nellore and Guntur districts and Hyderabad State. In the case of Godavari district the trade is mainly an export one to Bengal and Burma. Tobacco grown in the *lankas* in the Godavari river has the reputation of being the best.

In the South Arcot district tobacco produced at Sivapuri is famous for its aroma and is in great demand for chewing purposes from all over the Presidency.

There are some cigar factories at Trichinopoly. The raw material is obtained from Dindigul and from parts of Salem district. The latter is dark in colour and is used for cheroot making. The former is a little brighter in colour and is very largely used as fillers for high class cigars. For wrappers Java leaves are used.

In the Madura district cigar tobacco is grown in Dindigul taluk. Burning qualities are fairly good. The leaves are used as fillers and binders as for wrappers the manufacturers obtain leaves from Java and Sumatra.

Except for the tobacco grown in the *lankas* in the Godavari and Kistna rivers which is used in making Burma type cheroot, the tobacco grown on the black soils in the neighbourhood of Guntur which is used in the manufacture of cigarettes and the tobacco grown in the Dindigul taluk of Madura district which is used for making Trichinopoly type cheroots, the bulk of the tobacco grown in the Presidency is fit only for the manufacture of local cheroots, snuff, bidis and for chewing.

4. The following extracts taken from the reports on survey of cottage industries will be of some interest :—

- (i) *Kistna and West Godavari districts.*—Tobacco grown in the *lankas* of these districts is considered to be of superior quality. It is now exported in large quantities to other places. The possibilities of opening a cheroot factory here may be considered.
- (ii) *Guntur district.*—Bidi manufacture is carried on exclusively by Muhammadans in Guntur, Tenali, Vetapalam, and Ammanabrolu. *Tumuki* leaves, used for rolling bidis are obtained from the Nizam's Dominions, Kalahasti, Venkatagiri, etc., at Ra. 15 or so per 1,000 bundles. Tobacco required for bidis comes from Mysore to

Madras. Three varieties of tobacco at prices ranging from Rs. 4 to Ra. 13 a maund according to quality are mixed together to form the bidi dust.

This industry is carried on throughout the year and provides an excellent subsidiary occupation all the year round. It involves no outlay, nor does it demand any skill. There is a vast forest area in the district and if *tumuki* leaves could be grown locally in those forests the trouble and the expense of getting the leaves from distant places could be saved to the workers and pave the way for the development of the industry.

- (iii) *Kurnool district*.—Bidi manufacture is carried on in Owk and other places adjoining forests. *Tumuki* leaves which abound in forests are sold in headloads by the wood-cutters. Tobacco is either locally grown or obtained from Guntur.
- (iv) *North Arcot district*.—A majority of the Muhammadan coolie population find work in the manufacture of bidis more especially the women who observe purdah. The chief places of this industry in the district are Vellore, Ambur, Vaniyambadi, etc., besides many other important villages. The leaves are obtained from Cuddapah and Nagpur and occasionally from Punganur Zamindar forest but the quality of the leaves is very poor. All the quantity manufactured in the town of Vellore, Vaniyambadi, Ambur and other places are exported to places like Bowringpet, Pondicherry, Madras, Bezvada and other big cities and towns.
- (v) *Madura, Ramnad, Trichinopoly and Tinnevely districts*.—*Madura district*.—Of the industries which are connected with the manufacture of agricultural products of the Madura district the most important is the making of the well known Dindigul cheroots.

The tobacco required for the manufacture of cigars is obtained from the neighbourhood of Dindigul town and especially from Vedasandur and Vadamadura firkas. It is said that peculiar saltish water of Dindigul and other parts of the Madura district is specially suited for the growth of tobacco used for cigar manufacture. In addition to Messrs. Spencer's cigar factory which employs the largest number of hands there are many other small factories as well as individual workmen engaged in the manufacture of cheroots. Since the introduction of cheap bidis and cigarettes the industry has received a set back. There are three varieties of tobacco of which one kind is chewed, the second is made into snuff and the third is used for smoking. The chief characteristic qualities of the smoking tobacco is its ready ignition and retention of fire. This sort of tobacco is available in places where the soil and water contain nitrous salts, i.e., nitrates of potassium and sodium. Tobacco intended to be converted into cheroots is dipped for a night in pots of fermented jaggery water to which some salts are added and is taken out the next morning and dried in shade, so that it might be soft enough for working. It is generally wrapped up in gunnies and kept under press for a short time. When taken out for making cigarettes the ribs are removed from the stalks and the leaves cut into pieces and again dried in shade and rolled up into balls from which piece after piece is used for wrapping the cigar. Country tobacco is used for filling and wrappers of locally grown tobacco used for ordinary cheap cheroot and those imported from Java and Sumatra and other places for wrapping costlier and finer cheroots. After wrapping, cheroots are put in moulds for shaping and pressed and cut to the required length and measurement and thus made fit for use. Cigars wrapped up in foreign leaves give a better appearance and flavour compared with those wrapped up in locally grown tobacco. Further, the

leaves imported are much lighter in weight than the Indian tobacco and the duty which goes by weight is comparatively less on those wrapped up in foreign leaf.

Trichinopoly has been famous for its cheroots and the fact that it was once a Cantonment had much to do with the development of this industry.

The next important centre where this industry is carried on, on a large scale is Woraiyur, and the cigars manufactured here captured the foreign markets at one time.

The causes for the decline of this industry are (1) the heavy export duty on cheroots and (2) substitution of cheaper bidis and cigarettes. The former has adversely affected the foreign trade while the latter has stifled the trade within India. So long as the duty is not made *ad valorem* there seems to be no hope for the indigenous tobacco competing with the foreign which is many times much lighter than Indian tobacco. Secondly with the flooding of the country with the indigenous bidis and handy cigarettes which have become the fashion of the day the demand for the ugly looking cheroots has decreased considerably and the industry is consequently declining and the workmen are not having as much work as they used to have formerly. An attempt was said to have been made at Trichinopoly to grow tobacco of the Sumatra variety but the leaf came to be possessed of the same thickness and weight as the indigenous leaf. An investigation by the Agricultural Department as to the possibility of producing the same kind of tobacco on the Indian soil as that obtained from Sumatra and Java may be worth its while.

*Bidi Manufacture.*—The industry of bidi manufacture is carried on practically almost in all places in this group where there is a large Muhammadan population. This industry to a certain extent has given a set-back to the cheroot industry. This industry is carried on comparatively on a large scale in the Tinnevely district. It is also carried on in Palamcottah and Tinnevely Town. So far as the workers are concerned this industry provides an excellent subsidiary occupation for all the year round and involves no outlay nor does it demand any skill. At present the industry suffers for want of sufficient supply of bidi leaves which are imported from distant places and if this could be grown in forests adjoining this group of districts and a sufficient supply made available the industry will have a better future and give steady employment to those who observe purdah.

(vi) *Malabar, South Kanara and Nilgiri districts.*—Manufacture of bidis is one of the important cottage industries practised in Malabar. Though tobacco and leaves which are required for wrappers are not available within the district the industry is still flourishing on account of the large export trade it has with Ceylon and other places and the cheap labour procurable during the rainy season when preference is shown to indoor work. The chief centres of manufacture are Calicut, Tirur, Palghat, Tellicherry, Ponnani, Manjeri, and Badagara though some more towns of less importance have also fostered this industry.

Leaf and tobacco for manufacture are obtained from outside the district. Palghat and Calicut are the chief places where merchants stock them and sell to the retail traders. Bidi leaves are got from Cuddapah, Kurnool, Hyderabad and Nagpur. Tobacco in finely broken pieces required for making bidis is mostly obtained from Neppan in the Belgaum district of the Bombay Presidency and from Surat, Sangli, Gujarat and Mysore. Local tobacco is not used as it is said to be not suitable for the purpose.

5. In his report for 1929-30 the Director of Industries says :—

“There seems to have been a slight increase in the output of cigars during the year as compared with the previous year the demand for the high priced brands of mild quality especially registering an im-



provement. There seems no doubt that the demand for such mild smoking cigars is on the increase as compared with strong flavoured Indian blended cigars irrespective of the growth of the cigarette habit. New brands have been introduced to compete with the Dutch and Manilla cigars imported into this country with which they compare more favourably in quality and price."

6. It is not possible to furnish you with a list of factories (working on either small or large scale) engaged in the manufacture of cigars, cigarettes, cheroots, snuff and bidi.

7. With regard to marketing of crop, no detail survey has been made and in the absence of such information it cannot be exactly stated what the channels are through which the produce passes from the primary producer before it reaches the ultimate consumer. It may be generally stated that the crop is disposed of by the ryot in one of the following ways by selling (i) to local merchants, (ii) at the nearest shandy and (iii) to a whole-sale merchant in the nearest town.

8. The varietal and manurial experiments on exotic tobaccos conducted by the Department are still under trial. No systematic attempt so far has been made to improve by selection the indigenous varieties.

9. Statement showing the sowing and harvesting period for tobacco in the several districts of the Madras Presidency.

District.	Sowings or transplanting.	Harvest.
Ganjam .. .. .	Sown in August and transplanted in September—October.	Jan.—Feb.
Vizagapatam .. .. .		
East Godavari .. .. .		
West Godavari .. .. .		
Kistna .. .. .	October.	Jan.—Feb.
Guntur .. .. .	Oct.—Dec.	Feb.—Mar.
Kurnool .. .. .	July.	Jan.—Feb.
Bellary .. .. .	July—Aug.	Dec.—Jan.
Anantapur .. .. .	July—Oct.	Oct.—Feb.
Cuddapah .. .. .	Jan.—Feb.	Mar.—Apr.
Nellore .. .. .	Nov.—Jan.	Mar.—May.
South Arcot .. .. .	Nov.—Feb.	—May.
	Jun.—July.	Apr.—October.
Chittoor .. .. .	Dec.—Jan.	Apr.—May.
North Arcot .. .. .	Dec.—Jan.	Apr.—May.
Salem .. .. .	Aug.—Sep.	Jan.—Feb.
Coimbatore .. .. .	July—Oct.	Oct.—Feb.
Trichinopoly .. .. .	Oct.—Nov.	Mar.—Apr.
Tanjore .. .. .	Oct.—Nov.	April.
Madura .. .. .	Oct.—Nov.	Dec.—Jan.
		February.
Ramnad .. .. .	Aug.—Oct.	Jan.—Apr.
	Oct.—Jan.	
Tinnevely .. .. .	Oct.—Jan.	Jan.—Apr.
South Kanara .. .. .	Sep.—Nov.	February.

10. *Cultivation and curing of tobacco.*—The land chosen for tobacco cultivation is a light loam with good drainage facility. Great stress is laid on the quality of the well water and a peculiar brackish character is specially desired.

Seven or eight ploughings are given and the land is brought into fine tilth. Application of cattle manure and sheep penning is usually followed.

Seed beds are merely parts of the field with little banks raised round the sides to retain the water. No attention is given to their situation as long as they are close to the well. The beds are never covered or sheltered and as such good many seedlings are lost either due to sun or insect attack. The seedlings are ready for transplanting when the leaves are 3-inch or 4-inch long.

Previous to transplanting the land is ploughed up and ridges and furrows are made two feet apart. Generally the planting on the ridges is very close. Hoeing, weeding and watering is done as often as necessary.

The plants are topped when they are two and a half to three feet high and a few days before the bud appears. Immediately after topping shoots or suckers appear in the axil of the leaves and around the head of the plant, but suckering is done once only, about a fortnight after topping.

The plants ripen in ninety to one hundred days and when a few spots have appeared on the lower leaves, the plants are cut off close to the ground. They are allowed to remain exposed to the night dew and in the morning are gathered up and bulked into small circular heaps 2 feet high, the stalks outwards and the tips of leaves inwards.

These heaps are covered with straw and are not opened till the third evening after the harvest. The plants are then spread on the ground for a short time, and then hung up on horizontal poles with the stalks pressed close to each other. The stalks of the plants are slightly loosened from each other every morning all along the pole. The leaves are cured in fifteen to twenty days from the time of hanging up, the colour being rusty red, yellow and green; where the leaves have been too closely pressed together the colour is black.

When the stems of the leaves have become thoroughly dry, although the stalks may still be green, the plants are taken down and bulked in square heaps, the stalks being laid cross-wise over each other in alternate rows. The heaps are two feet or more in height. The leaves are not stripped from the stalks but bulked just as they are taken from the poles. This is done in the early sowing when the leaves are supple. These bulks are opened and re-bulked every two or three days when a blackish colour is produced, the fermentation is finished and the leaves are stripped off the stalk and tied up into bundles of 50 leaves weighing 1½ to 2 lb. each and baled.

The net profit per acre is estimated to be between Rs. 200 to 300.

NOTE RECEIVED FROM THE DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, POONA, WITH HIS LETTER NO. 8987, DATED THE 24TH JULY 1931. (SOUTHERN DIVISION, DHARWAR.)

Replies to particular questions are as under :—

(1) The main variety of tobacco grown in my Division is Kari-baglani (Nicotiana Tabacum), Shendi Surti (Nicotiana Tabacum) is another variety which is grown on a very small scale here and there and which is particularly dying. The following is the area under tobacco :—

Belgaum District (1925-26)	..	..	13,377
Mostly in Chikodi and Hukeri talukas.			
Kolhapur State (1921-22)	..	..	41,950
Satara District (1925-26)	..	..	11,422
Mostly Walva, Karad and Tasgaon talukas.			
Total	..	..	96,749

Roughly one lac acres.

Tobacco is mostly prepared into 'Jarada' as described in my bulletin and is sent out to various parts of India for making country cigarettes and for chewing.

(2) The chief tobacco tract comprises Chikodi and Hukeri talukas of the Belgaum District, Kolhapur State and Walva, Karad and Tasgaon talukas of the Satara District. Chikodi taluka alone grows 31,525 acres and forms the main centre of the tobacco tract with Nipani market.

(3) (a) Tobacco seed is sown in the first fortnight of July.

(b) Seedlings are transplanted in the 2nd fortnight of August.

(c) The crop is harvested in the 2nd fortnight of January.

(4) Curing is done when tobacco is to be exported in bundles to Goa side markets.

Method of curing is described in my bulletin.

(5) Outturn per acre varies from 400 to 750 lbs. dry leaf.

(6) There are 70 Jarada making factories at Nipani (as recorded in 1930-31) and about 100 in other interior villages. The quantity prepared at Nipani is estimated to be about 2,31,000 bags (1,84,80,000 lbs.) of 80 lbs. each. An equal quantity of Jarada is prepared in the interior villages and is brought to Nipani for sale. The total quantity of Jarada sold from Nipani market thus comes to about 37 million pounds.

About 2,500 hands are employed in Nipani alone during Jarada making season which lasts about 4 months in a year. Sometimes extra night work is also done at that time. Average cost of preparing Jarada from dry leaves at Nipani comes to 5 annas per maund of 32 lbs. In the interior it comes to about 4 annas. Jarada prepared here goes to all parts of India where country cigarettes are made from it. Cigarette making is a small industry in some places whereas it is a by-industry in others. The cigarettes are made by hand and differ in qualities according to the quality of Jarada and skill used in preparing them.

(7) Export and import from one place to another within India may be obtainable from the "Rail Borne Trade" which is not supplied to me and which may be available with you. The quantity of Jarada exported from Nipani comes to about 37 million pounds.

(8) Methods of marketing have been described in my bulletin No. 140.

(9) The cultivator regards tobacco as a most paying dry crop in the tract mentioned above and practises intensive cultivation as described in my bulletin.

(10) A selected strain of tobacco Nadiad No. 6 has been found to be more paying than local Kare-haglani and attempts are being made to introduce it in Chikodi taluka. A Tobacco Sale Society is started at Nipani to encourage cultivators to prepare their own Jarada and sell it by grading. Very little has yet been done, however, for improving tobacco trade at Nipani which requires closer attention of an expert hand.

(11) Photos in my bulletin No. 140 are interesting and it may be seen whether any of them will suit.

NOTE RECEIVED FROM THE DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, POONA,  
WITH HIS LETTER No. 8987, DATED THE 24TH JULY 1931 (GUJARAT TRACT).

All the Gujarat varieties of Tobacco come under *Nicotiana tabacum*. They are named locally as under :—

1. Gandiu, 2. Piliu, 3. Keliu, 4. Mohadiu, 5. Shengiu and 6. Saijpuri.

The area under some of these can be given as under :—

Variety.	Area in 1929-30.
Gandiu .. .. .	30,000
Piliu .. .. .	24,000
Saijpuri .. .. .	Not definitely known though rather negligible.

Of all these Piliu is the best for its colour, flavour, etc. The uses to which these tobaccos are prepared principally in order of importance are :—

1. Smoking in pipes (Hookah Chilm, etc.).
2. Smoking in the form of bidis or country cigarettes.
3. Chewing.
4. Snuff making.
5. Exported as cheap tobaccos for the purpose of blending for strength.

It is rarely used for cigarette making and almost nowhere for the purpose of cigarette making except perhaps as fillers in the cigar for which purpose the strong Gujarat tobaccos are somewhat suited. For wrappers of cigars they are useless being too brittle.

2. The Gujarat tract is one of the tobacco tracts in Bombay. Recently the cultivation of it is extending to more or less all parts of the Presidency.

3. The tobacco seed is sown in Gujarat with the advent of monsoons, *i.e.*, in early July, it is transplanted late in August and harvested from early February to late March according, as the crop is dry or irrigated.

4. The plant is cut when the leaves begin to yellow. Both individual leaf cutting and whole plant cutting is practised. Priming is not done. The harvested crop is either shade dried to make (a) green coloured tobacco or is sun dried for a varying number of days from 3 to 10 or 15 according as it is to be turned into, (b) black coloured tobacco, (c) red coloured tobacco, or (d) yellow coloured tobacco. On drying, the crop is made either into powder or the leaves of it are tied into brand weighing generally 1 lb., but varying in certain brands from  $\frac{1}{2}$  lb., to 10 lbs. even. Help of natural dew or artificial moisture applied to the leaves before collecting is taken to carry on the fermentation of the leaves which made into bundles, are heaped up in a corner in the house, the heaps being repeatedly rearranged to regulate their moisture contents heat and subsequent fermentation. The process gets complete within about 2 months since starting.

5. The outturn per acre of the cured leaf is about 800 lbs. for dry crop to about 1,400 lbs. for an irrigated crop.

6. Information under this head is not available at this station except that country bidis are enumerable as a cigarette industry in connection with the tobacco crop, the extent of which is not known.

7. No information of this point can be added except that during the last 10 years import of foreign tobacco both in the finished and raw form has almost doubled, and that the export of the local tobacco is somewhat constant except during the last two years.

8. Tobacco marketing is most ill-organised. There is no testing and no grading. On the one hand established reputation of certain places and even of persons can realize fabulous prices whereas on the other hand stuffs of markedly different qualities are rated uniformly without discrimination.

A strong tobacco of all shades of colour, green, yellow, red, black is in requisition. A thick bulky bodied leaf is welcome. Mildness is a positive demerit although harshness and fullness are differentiated.

In June 1930 it was brought to notice that the demand for Gujarat tobacco at Aden had considerably decreased during the previous year or so due to import of cheap tobacco from other countries. It was therefore urged that enquiries be made of the Aden Administration and the following information obtained :—

- (1) The quantity of import of tobacco from Bombay Port during the previous five years with its value.
- (2) The quantity of import of tobacco from other countries during the previous 5 years with its value.
- (3) The names of other countries from where tobacco was imported at Aden with quantities for each year for the previous 5 years.

A reference was accordingly made to the Officer-in-charge. Trade Registration Department, Aden, who replied that most of the tobacco from India was exported from Bombay and that there were no means of knowing the exact quantity that had come from Gujarat, that the quantity fluctuated considerably, that it was understood that there were shipping difficulties at Aden as some passenger ships did not carry tobacco and that there was an adverse effect on this commodity owing to the heavy fall in the value of the M. T. Dollar, which is the universal currency of Arabia (to where much of this tobacco is re-exported).

9. Cultivators used to regard tobacco as a paying crop formerly. Recently, however, the labour and other charges of cultivation have increased, the rates have fallen down to about 50 per cent. or less and even then there is no clearance of stocks on hand in these two seasons. Hence the crop has a gloomy future before it.

10. Departmental efforts in improving the crops consisted in isolating two high yielding strains. Gandiu No. 6 and Piliu No. 28 which each give about 10 per cent. higher yield than the local crops. The improvements being applicable to about 80 per cent. of the tobacco lands in Gujarat and even to areas outside Gujarat to which the improved types are spreading. Further efforts to improve the quality of Gandiu No. 6 to make it better suited to local tests and also to suit it for cigarette making are in progress through hybridization. This last named operation might find its use in the tract in about a couple of years time.

Efforts in respect of developing by cultivation and curing a thin mild plant yellow leaf for cigarette making purposes are also being made but they are yet in the experimental stage.

There are chances of developing the tobacco trade in Gujarat under the following conditions :—

- (a) The Piliu tobacco S. No. P-28 of Gujarat which is being found suitable for blending be exported to U. K. for that purpose. This would call for standardisation in curing and subsequent grading.

- (b) Efforts towards developing in Gujarat by all possible means of seed, cultivation, curing, etc., be done to develop the cigarette leaf tobacco in Gujarat so that the tobacco produce of the tract would find a larger variety of uses and secure one of the growing channels of trade in local requirements. This would relieve the slump in the present markets by making a new opening and would thus give stimulus to the cultivation of the tobacco of the right sort.

11. Photographs showing the improved varieties G. 6 and P.-28 as against the respective local types and photographs of individual plants of the leading Gujarat varieties are enclosed."

NOTE BY THE DEPUTY DIRECTOR OF AGRICULTURE, WESTERN CENTRAL CIRCLE, MAGWE, BURMA, RECEIVED WITH HIS D.-O. LETTER NO. 1131, DATED THE 31ST JULY 1931.

## CHAPTER I.

### GENERAL.

The genus *Nicotiana* comprises just over 40 species most of which are natives of the New World. Two only *N. tabacum* (Linn) and *N. rustica* (Linn), have any commercial significance. Of these only the varieties of *N. tabacum* are of present interest to us in Burma, *N. rustica* not being found growing outside the experimental farms of the province.

No information is available as to when tobacco was first introduced into Burma. At the beginning of the present century there were 70,000 to 80,000 acres in Lower and Upper Burma combined. To-day the Season and Crop Report shows an increase of about 50 per cent. (1,10,000 to 1,20,000 acres).

In the tabulated statement below the area in the main districts is shown over a series of years :—

District.	1920-21.	1921-22.	1922-23.	1923-24.	1924-25.	1925-26.	1926-27.	1927-28.	1928-29.	1929-30.
Kyaakpyu ..	4,863	4,923	4,891	4,841	5,058	5,020	5,025	5,349	5,144	5,163
Pegu ..	7,188	5,421	5,464	6,682	7,188	4,767	6,620	7,671	6,713	6,726
Tharrawaddy	6,251	3,020	4,620	6,409	7,050	4,775	5,429	5,310	5,662	7,929
Bassala ..	5,644	3,116	6,949	6,475	5,783	2,559	3,717	3,679	4,209	5,433
Hensada ..	12,242	7,291	11,192	10,824	12,216	6,784	3,753	7,855	3,140	11,585
Maubin ..	7,684	4,647	6,514	6,535	6,649	3,279	4,112	4,185	4,029	5,043
Toungoo ..	9,558	7,196	7,201	10,187	10,958	7,237	9,952	11,722	11,223	12,527
Thayetmyo ..	10,574	9,075	9,813	6,360	10,120	5,964	9,004	3,840	3,523	9,750
Pakokku ..	6,812	7,505	10,491	12,160	9,315	7,537	3,979	12,046	11,603	9,032
Myingyan ..	4,340	4,145	6,283	3,623	6,272	5,416	6,451	9,243	3,022	7,331
Sagaing ..	3,768	4,434	6,784	7,984	6,187	4,404	5,579	9,059	9,173	6,324
<b>Total Burma</b>	<b>1,00,310</b>	<b>81,374</b>	<b>1,06,839</b>	<b>1,14,522</b>	<b>1,14,105</b>	<b>81,665</b>	<b>1,00,363</b>	<b>1,18,163</b>	<b>1,14,307</b>	<b>1,17,050</b>

Most districts of the province grow some tobacco but only those in which the area is normally 5,000 acres or more have been shown. These, it will be noticed, are riverine districts. It is on land annually enriched by deposits of silt from flood-water of the big rivers that most of the tobacco of Burma is grown.

Yields per acre average 800 to 1,000 pounds of dry leaf (200 to 250 viss). If the post war value of this be taken at Rs. 40—50 per 100 viss the total acreage represents a production worth a crore of rupees. Of this amount Burma exports about Rs. 20 lakhs worth, but her imports in unmanufactured tobacco alone are in the region of Rs. 40 lakhs. In manufactured tobacco her imports are more than double this figure. It will be seen therefore that Burma, despite its quite considerable tobacco area, is by no means self-supporting.

## CHAPTER II.

### CULTIVATION AND CURING.

Cultivation and curing of tobacco is carried out in much the same manner in all the tobacco areas of the province. The methods followed by cultivators in Thayetmyo District are described.

Tobacco, as a money crop, is confined to those alluvial soils of river banks and islands which are under several feet of flood water for weeks at a time during the rains and are finally bared by the fall of the river level at the close of the monsoon in October—November. This land, which is peculiarly suited to tobacco cultivation and requires no manuring, is staked out in holdings of 2 to 3 acres each, and is claimed annually as soon as the water subsides by its owners of the previous year who live in the neighbouring mainland villages. For the most part the owners farm their own land but in a few cases it is rented out, the rent demanded being some 50 or 60 viss of tobacco (i.e. 25 per cent. of the normal crop) per acre.

It is the usual practice for the cultivator to live on his plot during the whole tobacco season from January to July.

Preparation for the crop begins with the seeding of nurseries on the high well-drained land above the river in the months of September and October.

The soil of the nurseries, which also is unmanured, is worked to a very fine tilth. The tobacco seed, mixed with several times its bulk of sand, paddy husk or other bulk provider, is then broadcast at the rate of one ounce of the seed per 100 square yards, and lightly covered. The nursery is sometimes weeded, but is neither watered nor shaded from the sun.

In December and January the plants in the nursery, which by then are about 6 inches high, are lifted by means of a taywin and the roots cut, only about an inch being left. The soil on the island or river bank where transplanting is intended will by that time have been ploughed with the Burmese plough 3 or 4 times and given a like number of harrowings, each harrowing being followed by a stroke with the "kyandon" to break down the clods. Any clods left after this are broken with a wooden mallet.

Lines for planting, 2 feet 6 inches apart, are then marked out by the harrow. Along these lines, at intervals 8 to 10 inches, small holes 3" deep and 6—8" in diameter are made to provide shade for the young plants. 12,000 to 15,000 plants are drawn from the nursery for each acre.

The planting is done by women who drag behind them a basket of the prepared plants, a pot of water and a ladle. In the small "shade hollow" a hole about 3 feet deep is made with a *su-khat* (dibble), and a dipper-full of water is placed in it. The plant is then inserted, the earth round the roots being "firmed" by putting the dibble in the ground just behind the plant and pressing towards it. Further watering is rarely given, but the weeding (for which a *mamooty* is the favoured implement) is usually very thoroughly carried out.

During the first few days after transplanting considerable damage is often done by "payit", the large brown cricket, (*Brachytrypes achatinus*, Stoll) and by the "po-than-gyaung," the so-called Greasy Cut-worm (*Agrotis ypsilon*).

No measures of prevention or cure are attempted in either case, the plants attacked being merely replaced by fresh drawings from the seed beds. Additional damage during growth is done by various caterpillars and by "pya" (aphides). Leaves damaged are generally cured, bulked and sold with the good leaves. It is only in the case of a very bad attack that they are rejected.

At the beginning of March, some 8 weeks after transplanting, the plants begin to show the first signs of flowering. The top shoots are then nipped off.

By the end of the month lateral branches bearing flower begin to appear from the axils of the leaves, and these too are nipped.

By mid-April the leaves, then full-grown, have become thick and sticky, somewhat brittle at the tip and turning yellow or spotted according to their texture. They are then ready for harvest.

The leaves are gathered singly, usually in the early morning, and carried to the homestead in baskets or on bullock carts.

In general no preliminary "wilting" is given, and curing starts almost immediately on arrival at the steading.

Three systems of curing are practised, the resulting products being:—

- (a) *Da-li-hse*.—chopped or shredded tobacco, used mainly for pipe-smoking.
- (b) *Kat-hse*.—which is used with chopped tobacco, stalks for the locally esteemed "maize cob" cheroot (*hse-baw-leik*).
- (c) *E-hse*.—the tobacco used for manufacturing the exported Burmese cheroot.

In the making of *da-li-hse*, for which in general only the inferior leaves are used, the tobacco is shredded with the dah as it is brought in from the field. It is then dried in the sun for 3 or 4 days, the heaps being moistened from time to time with water squirted from the mouth. The damp "tobacco" is finally packed tightly in wicker baskets, each holding about 1½ bushels, and a cloth tied over. As might be expected such "tobacco" is hot smoking and possesses very little flavour. It is popularly supposed to improve by keeping.

In making *Kat-hse*, the "Kat" (Trellis-like mat about 5 feet square made of bamboo strips placed 3" apart) is laid on the ground in the sun. The tobacco from the field is placed straightway on this *Kat*, some 6 or 8 leaves thick, the underside of the leaves being uppermost. A second bamboo *Kat* is then placed on top of this, forming a sandwich. With a series of these placed in line outside the cultivator's hut, long bamboo poles are laid across to prevent the *Kats* from being lifted by any breeze.

The Tobacco is left like this for 3 or 4 days until the mid-rib is dry. The *Kat* "sandwiches" are then collected and placed one on top of the other until a pile 3 or 4 feet high has been made, the top and bottom ones being lashed with bamboos for security. For 2 or 3 days they remain in the sun like this, being covered with a cloth or mat only if rain is expected. After this the *Kats* are again spread out on the ground individually and the leaves moistened by squirting water on them from the mouth, as in the case of *da-li-hse*.

When the leaves have become limp enough to handle without breaking they are taken out and tied into bundles or hands of 40—50 leaves each. These hands are removed into a shelter and built, butts outwards, into a heap varying in size with the crop but usually about 6 feet in diameter and 3 or 4 feet in height. The



heaps soon begin to heat and at the end of a week have to be broken down and re-built, the outside bundles being then placed inside the stack and *vice versa*. This rebuilding has to be repeated at the end of a further 15 days, then after lengthening intervals of 30 days, 2 months, etc. (the "heating" getting less fierce) until heating stops. The tobacco is considered to be at its best after it has been kept in the stack for about 7 months.

In curing *E-hse*, the leaves when brought in from the field are threaded through the bottom of their mid-ribs on to a thin strip of bamboo about 12 inches long. The free ends of the strip are twisted together forming an oval called a "hni". Each hni holds about 30 green leaves weighing approximately 30 *ticals* (1 lb.).

*E-hse* is shade cured, shade from the sun being provided by mat huts of a size usually about 15 feet by 30 feet. Half of the hut is used as working feeding and sleeping quarters by the cultivator and his family, the other half being occupied by bamboo poles on which the bundles of leaves are straddled. These bamboo poles, stretch horizontally across the hut in tiers at heights of 5, 7, 9 and 11 feet from the ground. The interval between bamboos on the same tier is about 9 inches at the commencement of the curing, being lessened to half that interval as curing progresses. Bundles of leaves are straddled on these poles about 4 or 5 inches apart, a 15 feet pole holding 40 bundles or so and giving 2½ to 3 viss of tured tobacco. Drying is unregulated and goes on to the break of rains in June, the leaf turning gradually from green to a golden nut-brown if conditions have proved favourable.

By the time the rains have been started 3 or 4 days the humidity of the air has caused the bundles in the drying shed to become limp. They are then taken down and built into heaps in the same way as the larger bundles of *Kat-hse*. No moisture, however, is added, and the rebuilding of the heap, which begins after about 7 days, takes place more frequently than in the case of *Kat-hse* the sequence of intervals normally being, 8, 12, 20 and 30 days, etc. *E-hse* is reckoned to be at its best after it has been kept for 5 or 6 months.

In considering the return for his labour which the cultivator may expect, it should be noted that given the same quantity of green leaf, the *Kat-hse* method of curing gives a 25 per cent. larger yield than is obtained by the *E-hse* method. *E-hse*, however, commands a higher price per 100 viss (by about 15 per cent.) and is less trouble to cure. Moreover the sale of *Kat-hse* is somewhat restricted. The *E-hse* method is therefore the one most generally employed. Most cultivators do some curing by all three methods, the worst leaf being used for *da-li-hse* and the best for *E-hse*. All curing is done by the cultivators themselves.

From the description given it will be realized that between the uncertain air-curing methods of Burma and the carefully regulated flue-curing of tobacco which is now so generally practised in countries outside there is a big gap.

The main difficulty in bridging that gap lies in the individualistic nature of the Burma tobacco holding and in a lack of capital which precludes the use of anything but easily obtained local material for curing-barn construction.

### CHAPTER III.

#### CHEEROOT-MAKING.

In the composition of the *hse-baw-leik*, "whacking white cheroot" which is so esteemed by the Burmese villager, tobacco-leaf plays very little part.

In the making of the Burma cheroot, three grades of leaf are recognised, the wrapper (ta-bet or ah-shay), the binder (Tat-ta-bet) or (ah-toh), and the filler (ah-sa).

Of these the wrapper and the filler serve vastly different purposes, the wrapper leaf being selected on account of its appearance and the filler on account of the flavour it imparts. In theory at any rate they should be represented by entirely different varieties of tobacco. In actual practice in Burma one variety of tobacco is generally made to serve all three purposes, with possibly a small admixture of other tobacco to the filler to give individual flavour.

In the attached chart is shown the disposal of 100 viss of good average tobacco when used for cheroot rolling.

Cheroot rolling in Burma is essentially a local industry, rollers of some degree of skill being found in almost all towns and in most tobacco villages. It is not a standardized occupation for which factory costings are usually kept nor one about which information is given at all freely to an enquirer. Any figures here quoted must be read with this in mind.

Although in the rolling of Burmese cheroots no factory system obtains, a single worker alone is seldom employed, the usual practice being for a skilled worker to be assisted by one moderately skilled and by an apprentice. The apprentice seldom does any rolling, her work being the preliminary occupations of casing, stripping, shaping the wrappers, and drying, winnowing and sieving the filler. In this she may from time to time be assisted by the roller of medium skill. The most skilled worker devotes her time to rolling only.

The output of a combination of three persons thus situated is therefore represented by the rolling of two, and on a daily average would work out at 600 large-size cheroots, 800 of medium size or 1,000 small giving respectively 16½ days, 16½ days and 17 days to finish up 100 viss of tobacco as originally issued. This, re-converted into single-worker terms, represents approximately 50 worker-days per 100 viss of tobacco handled.

In the chart the loss incurred in turning unmanufactured tobacco into cheroots is shown as 40 per cent. Of this a quarter (*i.e.*, that part which takes the form of wrapper and binder waste, ends and cuttings) could be used up subsequently as filler for cheroots of low grade. The net waste may therefore be taken as 30 per cent.

Rolling is usually done on contract, the general rate being 0-4-0 per hundred for the large size cheroot, 0-3-0 for the medium and 0-2-6 for the small.

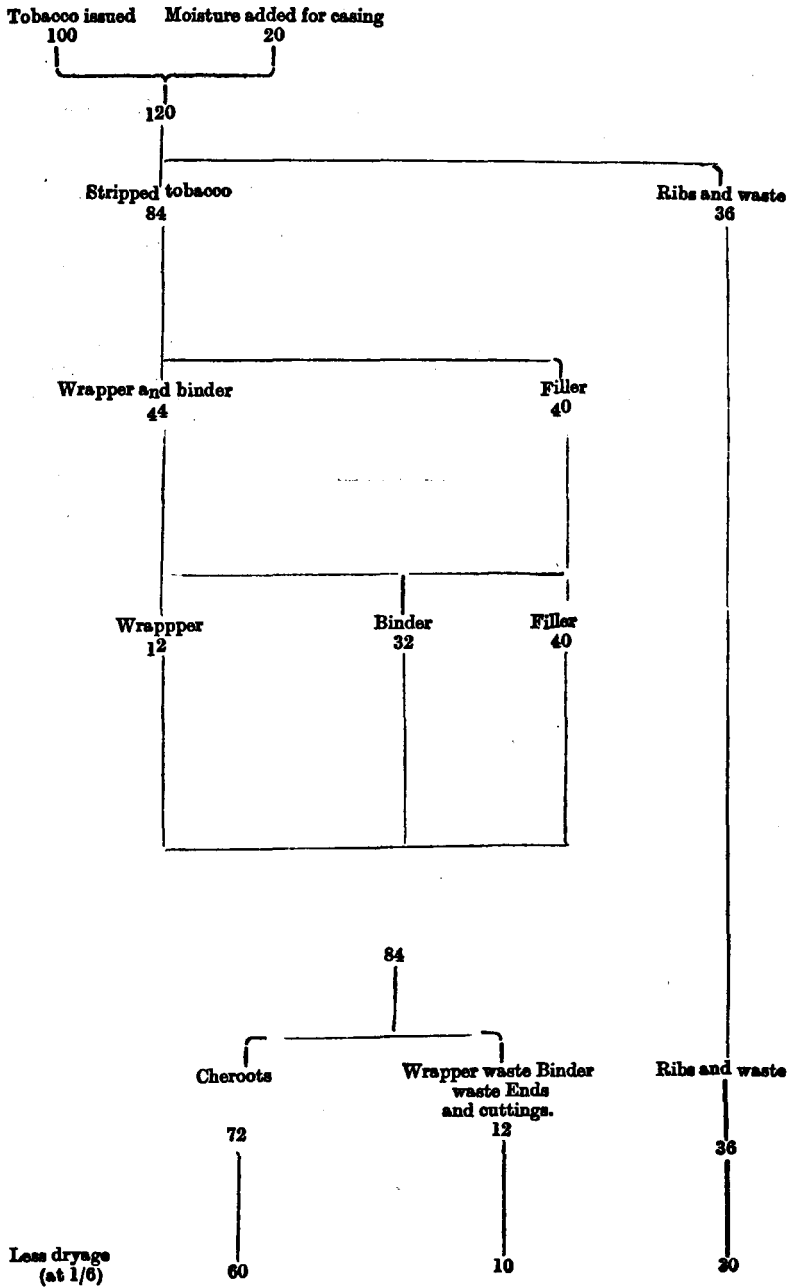
In the course of the rolling it has become customary in some districts to spray the filler tobacco overnight with "flavouring". These are made up from very secret recipes.

In general such flavourings are undesirable. Even the use of a mild solution of saltpetre, which does improve the "burn", is to be deprecated as it often masks slovenly rolling. The various concoctions of vanilla, brandy, gin and port-wine, tan-ye and sugar-water are to be more strongly condemned as mere pandering to the smoker of perverted tastes.

The flavour should be natural to the tobacco. Sufficient variations in this can be provided by a judicious mixing of different tobaccos in the "filler" used. In many parts of Lower Burma this practice has already been taken up, "Corinjee" and "lanka" tobacco being highly esteemed for the purpose.

It is to this demand for fillers with particular flavour that much of the Rs. 40 lakhs import of unmanufactured tobacco into the province is due.

Chart showing disposal of 100 viss good average tobacco when used for cheroot rolling.



## CHAPTER IV.

## TRADE AND DEVELOPMENT.

It may not be out of place in conclusion to examine the Burma trade in tobacco with a view to indicating lines of possible development.

From the outset let it be said that in Burma the actual cultivation of tobacco is on the whole well carried out. The ultimate product, however leaves much to be desired.

From the 100,000 or so acres under tobacco in Burma an out-turn of 8 to 10 crore pounds of dried leaf may be assumed. This, as has been stated, is worth approximately a crore of rupees. The area and the outturn could be very considerably increased if there existed a demand sufficient to make it worth the cultivator's while to substitute tobacco for other of his Kaingland crops.

In the attached tables, extracted from the "Maritime Trade of Burma", the country's imports and exports of tobacco are shown. The export figures relate only to Rangoon but it may be assumed that these comprise the bulk of the tobacco exported.

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Period.	Exports (from Rangoon) in lakhs of rupees.			Imports (whole of Burma) in lakhs of rupees.								
	Foreign.	Indian (or Coastal).	Total.	Unmanufactured.			Manufactured.			Total.		
				Foreign.	Indian (or Coastal).	Total.	Foreign.	Indian (or Coastal).	Total.	Foreign.	Indian (or Coastal).	Total.
Three year average 1919-20 to 1921-22	24.88	..	24.88	0.16	39.68	..	33.87	5.85	..	34.00	45.52	79.52
1922-23 to 1924-25	21.11	..	21.11	0.40	44.12	..	33.22	31.45	..	33.26	75.57	108.83
1925-26 ..	26.50	..	26.50	..	32.47	..	34.73	59.46	..	34.73	91.93	126.66
1926-27 ..	18.42	..	18.42	..	36.56	..	40.53	60.71	..	40.53	97.27	137.80
1927-28 ..	13.25	..	13.25	..	43.84	..	53.45	59.45	..	53.45	103.29	156.74
1928-29 ..	13.80	..	13.80	..	33.80	..	40.73	83.63	..	40.73	117.43	158.16

Dealing first with the exports it will be seen that these are small as compared with total imports. Nor do they show any sign of increasing, the Rs. 20 to Rs. 25 lakhs of the 1920-26 period having dropped to Rs. 13 to Rs. 14 lakhs in more recent years.

It will be seen that none of the tobacco exported goes to India, all being classed as "Foreign". Between manufactured and unmanufactured no distinction has been made in the figures given.

In its foreign trade Burma tobacco has to compete on a price-cum-quality basis with tobaccos from various parts of the world. So far as leaf is concerned one has only to see an average sample of cured Burma tobacco to realize its disability in this respect. Only by a marked improvement in its methods of curing and by adopting grading standards and maintaining them, could Burma ever hope to gain a footing in the quality market of the world for leaf tobacco. Even with the necessary reforms in this direction Burma would still lag behind unless cultivators could be grouped into producers associations prepared to organize sales and to direct public opinion towards their own product as is already done by the other tobacco producing countries of the world.

In the export of its manufactured product, the cheroot, Burma is in a position hardly any happier. It is a cheap smoke, but there is the same absence of uniformity. Even when uniform samples can be obtained the Burma cheroot is a smoke which is not to everyone's taste. In their report on "Tobacco" the Imperial Economic Committee class the Burma cheroot as "strong", and dispose of it with the somewhat cryptic comment that it appeals to those who have learnt to appreciate it in the East.

This perhaps does sum up the situation but there are nevertheless at home quite a number of smokers, whether perverted in their tobacco taste by residence in the East or cramped in pocket through living at home, to whom the Burma cheroot with its low price would be a very acceptable smoke if only its uniformity could be relied upon. At present it very emphatically cannot. Here then is a direction offering scope for enterprise in Burma.

Turning next to "Imports", under the heading "unmanufactured" the size of the figure for import from India will be noticed. This is in the region of Rs. 30 to Rs. 40 lakhs and represents imports of full flavoured tobacco, mainly from Madras and Bengal, for which there is a regular demand for filler work. There appears to be no reason why these tobaccos could not be grown equally well in Burma and this money kept in the country. The question, though important now, is one which is likely to come into more prominence in the near future if separation between India and Burma is effected and tariff walls between them are set up.

Examining recent movements for import of tobacco into Burma it will be seen that starting with an average figure of approximately Rs. 80 lakhs for the 1919-22 three year period, the import figure has almost doubled itself, and now stands more or less steady at Rs. 150-160 lakhs. With export figures on the decline we are thus shown as becoming increasingly a deficit tobacco country.

In this import the relative positions of manufactured and unmanufactured tobacco should be noted. Under "unmanufactured", the figures though fairly large, have undergone comparatively little change, the foreign imports under this head remaining negligible and those from India as already remarked standing round about Rs. 30 to Rs. 40 lakhs.

Turning next to the figures for import of "manufactured" tobacco we find under "foreign" the fairly considerable increase of about 20 per cent. (from Rs. 33 lakhs to Rs. 40 lakhs) but this is completely overshadowed by the increased import under Indian or Coastal. This shows a jump from Rs. 5,85 lakhs in the first 3 year period to Rs. 31,45 lakhs in the second period. The following year it showed a further jump to Rs. 59,46 lakhs at which figure (approximately) it stood for a further 3 years, rising again in 1928-29 to Rs. 83,63 lakhs. The present figure (1928-29) is thus just over 1,400 per cent. greater than the figure for the 1919-22 period.

In seeking an explanation for this very marked increase we find it in the cigarette imports. Figures for these are tabled below.

*Cigarette Imports into Burma.*

Period.	Foreign.	(lakhs of rupees.) (Indian or Coastal.)
Three year Average 1919-20 to 1921-22 .. ..	32,64	4,71
Three year Average 1922-23 to 1924-25 .. ..	31,29	30,39
1925-26 .. ..	32,68	58,68
1926-27 .. ..	38,77	60,14
1927-28 .. ..	50,70	58,37
1928-29 .. ..	39,10	82,40

These figures very plainly bring out the trade trend of recent years. They show no appreciable increase in cigarettes from "foreign" but the enormously increased takings under "India" (Rs. 4,71 lakhs to Rs. 82,40 lakhs) stand out as the sole factor responsible for Burma's increased import of tobacco in the past few years. They provide us with a pointer for future work. Whether these cigarettes are made by Indian firms, or by European firms operating in India, is immaterial. They are being made outside Burma and they represent an out-going of close on a crore of rupees.

Burma has become infected with the cigarette habit. If this habit is going to remain it would surely be wise of Burma to see that it is satisfied from tobacco grown and manufactured within its own shores.

DEMI-OFFICIAL LETTER FROM THE DIRECTOR OF INDUSTRIES, BIHAR AND ORISSA, PATNA, TO D. MILNE, ESQ., AGRICULTURAL EXPERT, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. 10500, DATED THE 8TH AUGUST 1931.

Your demi-official letter No. 1485-Agri., dated 3rd July 1931. I give below the information as desired therein.

1. (a) Tobacco Manufacturers (India), Ltd., Basudeopur, Monghyr.
- (b) Power driven.
- (c) Cigarette and smoking tobacco.
- (d) Not available.
- (e) 1,800-2,000.

The boycott of European style cigarette had a disastrous effect for a short time on local factories of these and produced quite a considerable boom in Biri

manufacture. It is expected that a permanent new industry of some importance may result. The leaf covered *biris* has a peculiar forest fragrance not paralleled in any kind of cigarettes.

3. There was an increase but not at present.
4. *Desi* as well as foreign.
5. Marketing is very bad owing to boycott and economic condition.

DEMI-OFFICIAL LETTER FROM MR. THIN NYUN, FINANCIAL COMMISSIONER'S OFFICE, BURMA, TO MR. D. MILNE, ACTING AGRICULTURAL EXPERT, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No- 806/61-81, DATED THE 11TH AUGUST 1931.

With reference to your demi-official letter No. 1485-Agri., dated the 3rd July 1931, I am desired to say that the Chief Inspector of Factories, Burma, who was consulted in the matter writes as follows :—

“There is only one registered tobacco factory and I furnish the following information which is all that is available in this office.

“ (1) (a) The Indo-Burma Tobacco Company, No. 2, Park Road, Rangoon.

(b) Power driven.

(c) Cigarette.

(d) No information available.

(e) 29.

(f) Nil.

“Items (2) to (5). No information available.”

2. I am, however, to forward herewith a copy of a note on Cheroot making Industry prepared by Mr. L. Nicholas, Government Pottery Expert, Burma, for submission to the Royal Commission on Labour, together with a memorandum thereon by Mr. W. F. Grahame, late Superintendent of Cottage Industries, Burma, in the belief that they might be of interest to you.

#### *Cheroot Making.*

The note written by Mr. Nicholas contains a good deal of information about the industry. He does not mention that quite an appreciable number of cheroots are made in and around Mandalay. The description that he gives of the industry is typical of Lower Burma. My enquiries into cheroot making in Upper Burma about 10 years ago, and again recently when asked for information by the Director of Agriculture, indicate that workers in Upper Burma turn out only about half the number of cheroots *per diem* turned out by workers in Lower Burma. There is less division of labour too. The majority of cheroot makers in Upper Burma are also cultivators, but there are some cheroot makers, especially in Mandalay Town, who do this work all the year round. Otherwise the conditions of this industry in Upper Burma are very much the same as those in Lower Burma.



(1) According to the census of 1921, there are 16 establishments (employing 10 or more persons) in the whole of Burma. But Mr. Nicholas found in his recent visit to Moulmein and Danubyu that there are 20 such establishments in those two centres alone, besides 140 establishments employing less than 10 persons. He estimates a further 30 establishments employing 10 or more persons at Yandoon and Proms (15 at each). At a rough guess I estimate 400 cheroot making establishments large and small in the Province.

(2) According to the recent investigations of Mr. Nicholas the number of persons employed in them varies from 1 to 29 roughly and the average is somewhere about 5 or 6. On the other hand, the total number of tobacco manufacturers in Burma according to the census of 1921 is 1,093 males and 13,021 females. I think it must be taken that the total number of tobacco makers in Burma is not less than the figures given in the census report for 1921 and the explanation of the difference in figures probably is that there are a great many of these persons working in their own homes and not in one or other of the establishments mentioned either in the 1921 census or in Mr. Nicholas's figures.

Boys are employed to cut off the surplus ends of the cheroots, and to pack, and sometimes on other unimportant processes, but not on any heavy or difficult work, nor are they employed in large numbers.

(3) (a), (b). The average earnings are small and the number of hours work is fairly large, but I very much doubt if every worker works for the whole of the time that he is supposed to work.

(c) The minimum age of children is not mentioned by Mr. Nicholas, but it might be assumed to be 10 years. (Mr. Nicholas has since confirmed this age).

(d) The employment is sedentary, but this does not appear to affect the health of the workers as they always have plenty of light and air around them. Until I saw Mr. Nicholas' note I had never heard that tobacco workers lose their hair early, not that their eye-sight is impaired. (He also says that he had never heard this before). This might be investigated later on, if necessary.

(4) In the meantime I do not think that any control by Government is required.

W. F. GRAHAME,

*Superintendent, Cottage Industries.*

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*C.—Cheroot making in Moulmein and Danubyu.*

*Selection of sample centres.*—Excluding Rangoon City, the largest centres in order of importance are said to be Moulmein, Proms, Yandoon and Danubyu. The oldest centre of the industry is Moulmein.

*Moulmein and Danubyu* were selected for study as it was considered that the conditions at Proms and Moulmein, and those at Yandoon and Danubyu would be similar.

*Method of Investigation.*—As cigar making establishments are not grouped in well defined areas as in the case of clay-working, but are scattered all over

the town, I sought the assistance of local officers and residents not only for locating the establishments, but also for obtaining proper introductions to workers lest I should be mistaken for an income-tax official.

At Moulmein, U Po The, Deputy Commissioner, very kindly deputed U Khin Maung, Township Officer, to put me in touch with the ward headmen. The Thugyis (all quite intelligent men) of each ward accompanied me in my round of visits to each establishment in his ward, U Khin Maung himself accompanied me in several of my morning rounds.

At Danubyu, the necessary assistance was given by U. Kun, *Bar-at-Law*, M.L.C., who took me round to several establishments and also arranged for two residents to accompany me in my rounds. U Hpay U, landowner and rice miller, was also of great help in sending round people to assure owners of establishments and workers that I was not an income-tax official and that no sinister motive lay behind my enquiries. Even with these precautions it was difficult in some quarters to allay suspicion.

The information obtained by personal observation and enquiries was supplemented and checked as far as possible by information gained from the more intelligent of the residents well acquainted with the working conditions of the industry.

#### *A—Processes of Manufacture.*

*Raw materials.*—Three sizes of tobacco leaf are used, the largest size is for the outside wrapper of the cheroot and the medium size is for the inner layer. The smallest size is for the core. The scraps after cutting the two larger leaves to correct size and shape as well as the ends cut off after making the cheroot, are also used for the core.

*Labour.*—Practically all the work is done by women. Workers are always paid at piece work rates. The rates at Moulmein and Danubyu are the same, and appear to be standard rates.

There are four main processes in which skilled labour is necessary, namely :—

		Piece work rate.	
		Rs. a. p.	
1. Stripping leaf	.. ..	0 4 0	per 10 viss.
2. Stretching large leaf	.. ..	1 4 0	per 10 viss.
3. Cutting stretched leaf to shape and size.	.. ..	1 4 0	per 10 viss.
		or	
		0 4 0	per 1,000 pieces.
4. Rolling cigars	.. ..	1 0 0	to 1-8 according to size.

A good cigar-maker is supposed to be skilled in all the above processes and in small establishments each worker does all the required operations as occasion arises. Learners are usually employed in stretching medium leaf and are paid one anna per viss. In large establishments, however, there is division

of labour, each worker being engaged in one process only. In addition to the above processes there are minor operations done by unskilled labour.

Piece work rate.

- |  |  |
|--|--|
| 5. Crushing small leaf for core of cigar.  | Re. 1 per 10 baskets (men).                  |
| 6. Breaking up ends of cigars for core   | One anna per basket (children).              |
| 7. Polishing (before ends are cut off generally done between 2 plates of glass). | One pice per thousand (men).                 |
| 8. Cutting off ends of cigars ..   | One pice per hundred (boys).                 |
| 9. Fixing labels to cigars ..  | One anna per thousand (children).            |
| 10. Packing .. ..  | One anna per 10 packets of 100 cigars (men). |

In most establishments this portion of the work is done by the household of the owner of the establishment.

Polishing is part of the work of cigar rollers, but they sometimes employ boys or men to do it, paying 1 pice per hundred.

Men or boys are occasionally employed both to cut off ends and pack in which case they are paid Rs. 1-4 per 10,000.

Where boys or men are employed in small establishment it is casual labour, but some large establishment permanently employ one or two for processes numbered 5, 7, 8 and 10.

*Specimen Establishments (large) to illustrate division of labour.*

(1)	Moulmein.		Danabyu.		Remarks. (6)
	Ma Aye Yin. (2)	Mrs. Joseph. (3)	U Kyaw Hoo. (4)	Me Shin. (5)	
Stripping .. ..	2	2	1	1	} Women.
Stretching leaf .. ..	3	3	2	1	
Cutting leaf .. ..	2	1	1	1	
Rolling cigars .. ..	10	7	7	4	} Men.
Minor processes .. ..	3	1	2	2	
Average hours of work ..	7 hours.	7 hours.	7 hours.	7 hours.	

Generally speaking, to keep four cigar rollers continually employed at least one worker each for stripping, stretching leaf and cutting leaf are needed.

*Number of establishments and persons employed.*

Table A below gives the number of workers in Burma as given in the 1921 Census.

Table B gives the number of workers for establishments employing 10 or more employees, according to the 1921 Census.

Table C gives the number for Moulmein and Danubyu at the time of my visit to these towns in July 1930.

TABLE A.

## Group 75.—Tobacco Manufacturers.

Division.  (1)	Workers.					
	Total workers.		Workers with an agricultural or other subsidiary occupation.			
			Agricultural.		Other.	
	Males. (2)	Females. (3)	Males. (4)	Females. (5)	Males. (6)	Females. (7)
Arakan Division ..	11	229	..	..	..	..
Pegu Division ..	429	4,696	..	3	4	90
Irrawaddy Division ..	96	2,584	2	4	..	28
Tenasserim Division ..	144	2,256	..	3	4	35
Magwe Division ..	38	321	..	2	5	1
Mandalay Division ..	99	1,927	..	1	..	1
Sagaing Division ..	177	301	11	3	22	17
Meiktila Division ..	99	707	8	5	5	23
Divisional Total ..	1,093	13,021	21	24	40	195

TABLE B.

## Group K.10 (ii) Tobacco, Cigar and Cigarette Factories (without mechanical power).

District.  (1)	Number of Establishments. (2)	Employees.		Total. (5)
		Males. (3)	Females. (4)	
Rangoon .. .. .	11	88	359	447
Prome .. .. .	3	4	55	59
Henzada .. .. .	1	..	20	20
Mandalay .. .. .	1	..	12	12

TABLE C.

Number of Cigar making Establishments and Workers at Moulmein and Danubyu (July 1930).

Magnitude.	No. of Establishments.	Workers.			Total workers.	Remarks.
		Men.	Women.	Children (under 14).		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>Moulmein (Municipal limits) area 16 sq. miles.</b>						
1 ..	18	2	16	..	18	Population. Males 38,076 Females 23,235 <hr/> 61,301
2-4 ..	39	1	110	6	117	
5-9 ..	44	..	254	18	272	
10-19 ..	17	2	202	13	217	
20-29 ..	1	..	22	3	25	
Totals ..	119	5	604	40	649	
<b>Danubyu (Municipal limits) area 5 sq. miles, population 19,211 Census 1921 8,012.</b>						
1 ..	4	..	4	..	4	
2-4 ..	8	..	29	..	29	
5-9 ..	8	5	40	5	50	
10-19 ..	1	2	11	..	13	
Totals ..	21	7	84	5	96	
<b>Nandawg one Village (adjoining Danubyu) 200 households.</b>						
1 ..	2	..	2	..	2	
2-4 ..	7	..	23	2	25	
5-9 ..	13	..	77	..	77	
10-19 ..	1	..	8	2	10	
Totals ..	23	..	110	4	114	

## NOTE TO TABLE C.

The demand for cheroots fall during the rains, hence the number of workers is generally larger in the dry season. In Moulmein the number of skilled workers increases by about 30 per cent. in the dry season as the demand from the Federated Malay States is largest during this period. At Danubyu however, there is no perceptible increase because a good number go out for work in the fields during the harvesting season when more money can be earned.

At one time Moulmein was the chief centre of the industry but with the growth of rival establishments at Rangoon, Prome and elsewhere, its fame has declined somewhat. A few years ago Swe Choon and Co., a local tobaccoconist firm, opened two cigar making factories in the Federated Malay States, one at Singapore and one at Taiping, picked cigar rollers being sent to work at these factories on monthly wages. The following official figures indicate the number of Moulmein workers now employed at the two factories mentioned above :

	Numbers emigrated to F. M. S.	Numbers returned.
1928 ..	35	1
1929 ..	47	2
1930 ..	12	..

The tobacco used at these factories is sent in the prepared conditions, *i.e.*, in rolls of stretched leaf. Eight establishments in Moulmein work for the firm in this work.

*Working days per month*.—This varies from 15 to 25 days per month in most establishments. In some establishments with a steady output it is generally 20 days. Allowing 4 sabbath days and 1 day for illness, it never exceeds 25 days. The number of working days may be less than 15 days during those months when rain is more or less continuous as work is delayed on account of the difficulty of drying tobacco leaf.

*Hours of Work*.—Since piece work rates prevail, the hours of work are not fixed. In general this is from 7--8 hours at Danubya and from 8--10 hours at Moulmein. The usual hours are from 7 A.M. to 5 P.M. with an hour off for meals. In small establishments where outside labour is not employed 3 to 5 hours is usual.

Hours of work generally varies with the individual worker. A slow worker would work longer hours than a fast (skilled) worker to earn the same amount of money. The skilled worker usually does 7 hours. Moulmein cigar makers are generally more skilled than those at Danubya.

So also a woman with a family works only about 3 hours as she has to attend to household duties as well. Children do about 5 hours a day.

*Earnings*.—Although piece work rates are uniform, the earning would vary with the hours of work. The figures given below are on the basis of an 8 hours working day.

<i>Skilled Work.</i>				<i>Average earnings per day.</i>
Stripping .. .. .	..	..	..	3 to 4 annas.
Rolling leaf .. .. .	..	..	..	5 to 6 annas.
Cutting leaf .. .. .	..	..	..	5 to 6 annas.
Making cigars .. .. .	..	..	..	5 to 6 annas.
<i>Unskilled Work.</i>				
Children .. .. .	..	..	..	2 annas.
Men .. .. .	..	..	..	4 annas.

*Effects of occupation on health*.—The work is done under healthy conditions, there being sufficient light and air in practically all establishments.

*Occupational diseases*.—It is said by some workers that the handling of tobacco tends to make the hair fall off and to weaken the sight. I am not in a position to discover what percentage of the workers are actually affected, if indeed cause is attributable to tobacco, but if it does affect at all, it is probably due to contact of dirty fingers with hair or eye during working periods. A certain amount of dust is produced during the process of sifting crushed tobacco used for the core of the cigars, and some of it might settle on workers. But crushing is not done at frequent intervals. Cigar manufacturing is sedentary work and a fair amount of outdoor exercise is required to keep good health, but most workers hardly take exercise beyond the walk to the establishment where they work and back home. The health of children employed do not appear to suffer.

L. A. NICHOLAS,

*Pottery Expert.*

LETTER FROM L. B. GREEN, ESQ., DIRECTOR OF INDUSTRIES IN CHARGE, MADRAS, TO THE AGRICULTURAL EXPERT, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA S. W., No. 1149-A.31, DATED 11TH AUGUST 1931.

REFERENCE.—Your letter No. 1495|Agri., dated 3rd July 1931—Tobacco.

There are only two factories in the Madras Presidency manufacturing cigars on an organised scale and the following remarks on tobacco manufacture are based largely on information gathered from these two factories.

1. *Importance of the business of making cigars, cigarettes and snuff, etc.*—The business of making cigars, cigarettes and snuff is important as it gives employment to many.

As regards snuff, no statistical information is available. It is used by a large section of the public and the manufacturers carry on this industry on cottage lines, no snuff being produced by any established factories.

(a) *Name and situation of each factory—*

(i) Messrs. Spencer and Co.'s Cigar Factory, Dindigul, South Arcot.

(ii) Messrs. McDowell and Co., Ltd., Post Box 36, Madras.

(b) *Whether the machinery is power driven—*

(i) Power driven—cigar box department only.

(ii) Entirely hand operated.

(c) *Kind of products turned out.*—Cigars, cigarettes and pipe tobacco by No. (i) and cigars only by No. (ii).

(d) *Quantity of manufactured products turned out.*—A little over half a crore cigars weighing 50,000 lbs. were turned out by Messrs. Spencers in the period July 1930 to June 1931. The quantity of cigarettes and pipe tobacco turned out for the same period by the factory is insignificant.

30 to 40 lakhs of cigars weighing from 45 to 60 thousand lbs. are turned out annually by Messrs. McDowell.

(e) *No. of workers employed.*—250 men in No. (i) and 80 to 100 men and boys in No. (ii).

(f) *Any other information of interest regarding these factories.*—In Messrs. McDowell and Company's factory, cigars are made, matured and treated on entirely up-to-date lines, and by the same methods as those employed in present day factories in Holland and Germany.

2. No information is available as to the amount of cigars, cigarettes, snuff, etc., made as cottage industry. There are small factories besides individual workers in Dindigul and Woriur rolling cheroots for local consumption and export to other places. Bidi manufacture is also carried on extensively in the Districts of Madura, North Arcot, Guntur, Malabar, and Kurnool as well as in the City of Madras. Bidis are mostly consumed locally by the poorer classes and also exported to Ceylon, Rangoon and the Straits Settlements.

3. There has been a steady decline in the outturn of cigars in both these factories and sales have dwindled to about half of what it was 10 years ago. The steadily increasing habit of cigarette smoking and particularly the heavy import duties imposed in the consuming countries and the Empire markets,

have helped practically to kill the export trade in cigars. This result is only to be expected where duties are levied on the basis of weight and not on value, as it results in the much cheaper Indian product having to pay exactly the same duty as expensive Havana cigars costing 6 or 7 times as much.

4. The cheaper qualities of cigars are either made entirely of Indian leaf, or consist of pure Indian fillers and bunch wrappers with an imported outside wrapper. Medium priced brands contain a blend of Indian and foreign fillers with imported wrappers, while the best brands are made entirely of imported leaf. The last named however have a small sale compared with the cheap and medium priced lines.

5. The enormous increase in cigarette smoking coupled with the crushing duties levied on Indian cigars in other countries lends colour to the fear that the industry in India is never likely to reach the same state of importance which it enjoyed in past years. A large share of the cigars manufactured is consumed in India itself, the balance is exported to other countries, the chief markets being Great Britain, British East Africa, South Africa, Egypt, Basra, etc.

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COPY OF LETTER FROM THE DIRECTOR OF INDUSTRIES, UNITED PROVINCES, CAWNPORE, TO THE DIRECTOR-GENERAL OF COMMERCIAL INTELLIGENCE AND STATISTICS, CALCUTTA, NO. 2309/84, DATED THE 4TH SEPTEMBER 1931.

With reference to your letter No. 4583-C.I.E., dated the 14th July 1931, I have the honour to state seriatim in answer to your queries raised in the letter under reply :—

(a) Methods of marketing of tobacco differ in the villages and towns. In villages most of the population prepare their own tobacco for smoking and chewing which are the only forms of consumption there. They of course, get their supplies of raw tobacco from the petty shop-keepers, who, in turn, get their supplies either directly from the producers or from the whole-sale dealers in the towns.

Marketing in the cities of manufactured smoking tobacco is merely in the hands of shop-keepers. Very few prepare their own tobacco; whereas chewing tobacco is had from the shop-keepers both in its raw and manufactured state.

There are also some larger firms in the cities whose business is to export and import raw tobacco from and to different parts of India. They are chiefly situated in the towns.

(b), (c), (d), (e) and (f) do not arise as there are no factories in this province.

(g) No information can be given with regard to the approximate quantity of different sorts of tobaccos manufactured in U. P., as no data can be available of articles manufactured by the workers in the cottages as they do not maintain any records of their products.

(h) There has been an enormous increase in the manufacture of Biris in this province. They were not known before. As they are made on a cottage industry basis, no information as to the extent to which this increase has gone can be given.



(i) The tobacco used in the manufacture of these Biris is all indigenous. Supplies of this in the United Provinces is had mostly from the Central Provinces and Bengal.

COPY OF LETTER FROM THE DIRECTOR OF INDUSTRIES, BENGAL, CALCUTTA, TO THE DIRECTOR-GENERAL OF COMMERCIAL INTELLIGENCE AND STATISTICS, CALCUTTA, No. 15342-D.I.G., DATED THE 6TH OCTOBER 1931.

With reference to your letter No. 4578/C.I.E., dated the 14th July 1931, and subsequent reminder asking for particulars on several points raised therein in connection with the preparation of a note on Indian tobacco, I have the honour to state that in the absence of a suitable departmental agency for the collection of industrial intelligence, we are not in a position to supply up-to-date and exhaustive information on all the points. Such information collected from various sources and at different times as is already available from our records, is, however, noted below for your information and for such use as you will like to make of it in preparing the note.

2. *Item (a) of your letter.*—The Department is not aware of any special conditions that obtain in this country for marketing of Indian tobacco. Raw leaf tobacco, like other agricultural commodities, is sold in small quantities in *hâts* and market places by the cultivators, wherefrom it is collected by the middlemen *Beparis* or *Aratdars* brought to Calcutta or stored in other important trading centres for supply to big buyers.

3. *Item (b) and (c) of your letter.*—There is no cigar, or snuff factory coming within the operations of the Indian Factories Act. We have in our record names of 9 concerns within the Calcutta Municipal area where cigars or roughly rolled cheroots are prepared. In some cases small disintegrating mills are used driven by electric motors for manufacture of ball tobacco for Indian consumption but in general such concerns do not come within the definition of Factory under the Indian Factories Act. The names of such concerns are noted below :—

1. Addy, Hurry Das, 1 Chandney Chowk Street, Calcutta.
2. Bengal Cigar Corporation, 14|1, Ramkanto Bose Street, Calcutta.
3. Great Eastern Tobacco Co., 14|A., Clive Row, Calcutta.
4. Macropolo D. & Co., Government Place, East, Calcutta.
5. Nassin Bros.—158, Dharamtola Street, Calcutta.
6. Spencer & Co., Ltd.,—58 Strand Road, Calcutta.
7. National Cigar Factories—49, Maniktolla Street, Calcutta.
8. Bengal Tobacco Co.,—3|B, Radhakanta Jew Street, Calcutta.
9. Ranee Tobacco & Cigar Manufacturing Co.,—45, Chandney Chowk Street, Calcutta.

The names of the power driven cigarette factories using modern automatic cigarette making machinery and coming within the operations of the Indian

Factories Act are noted below :—

1. The Continental Stores Agency Co., Ltd., 82, Nimitola Ghat Street, Calcutta.
2. The American Eastern Tobacco Corporation Ltd., 19, Dum Dum Road, P. O. Ghughudanga, 24-Parganas.
3. The Calcutta Cigarette Factory, Grand Trunk Road, Belur, Howrah.
4. The Rameshwar Tobacco Factory, 362 Grand Trunk Road, Salkia, Howrah.

The above factories are confined to the manufacture of cigarette only.

4. *Item No. (g) of your letter.*—Cigar making as a home industry is practised by a few families in Calcutta and to a very limited extent in the Rangpur area, but the production under this head is negligible. Snuff is prepared in Bariupur, Belghoria, Agarpara in the district of 24-Parganas and in Serampore in the district of Hooghly. We have no information about the scope and extent of the manufacture. There is a wide-spread distribution of *bidis* manufacture diffused throughout the province, but largely developed in Calcutta where *bidis* are manufactured by collections of people in godowns and dwelling houses. All the processes are carried out by hand. It is estimated that in and in the neighbourhood of Calcutta there are some 13 factories of this character where 10 or more persons regularly roll *bidis*, while in addition to these there are numerous shops and places in every bazar and street in Calcutta where *bidis* are rolled mostly by juvenile labour. As far as the information of this Department goes no record is kept of the total sale or consumption of *bidis* and it is unlikely that any accurate statistics in this regard can be obtained.

5. *Items Nos. (d), (e), (f), (h) and (i) of your letter.*—No reliable information nor any further particulars of interest regarding those factories, under the above items, are available in our records.

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COPY OF LETTER FROM THE DIRECTOR OF INDUSTRIES, PUNJAB, TO THE DIRECTOR-GENERAL OF COMMERCIAL INTELLIGENCE AND STATISTICS, CALCUTTA, NO. 9350, DATED THE 21ST OCTOBER 1931.

With reference to your letter No. 4585-C.I.E., dated the 14th July 1931, and a subsequent reminder No. 6618-C.I.E., dated the 26th September 1931, I have the honour to give below the required information *seriatim* :—

(a) Tobacco is marketed mainly in the form of raw uncured leaves. Cultivators, after cutting it from the field, tie the leaves in the form of hanks which are taken to the commission dealers in mandies for sale. In many villages the output is just sufficient to meet the local requirements. Sometimes tobacco leaves are also sold by villagers to the local shopkeepers in the form of rough cured leaves, who mix them with *rab* (sugar mollasses) and pound them into ball tobacco used for smoking in 'hookahs'. A cigarette manufacturing factory recently established in Lahore, gets its supplies of tobacco from the Madras Presidency.

(b) and (c). The India-Ka-Tobacco Company, McLeod Road, Lahore, is the only concern manufacturing cigarette with modern machinery.

The machines installed in the India-Ka-Tobacco Company are worked by power. The following concerns engaged in the manufacture of cigarettes employ hand labour :—

- (1) M. Abdul Ghani, Mozang, Lahore.
- (2) The Northern India Tobacco Company, Lahore.
- (3) Phagoo Ram, Anarkali, Lahore.

Cigars are not manufactured anywhere in this province.

(d) and (e). The following statement gives the production and value of each cigarette factory :—

Name of factory.	Production.	Average number of persons employed.	Remarks.
1. The India-Ka-Tobacco Company, McLeod Road, Lahore.	Average weekly outturn 60,000 cigarettes valued at Rs. 500.	25	It was started only a few months back.
2. M. Abdul Ghani, Mozang, Lahore.	Daily production is about 4,000 cigarettes and are sold at rates varying from Rs. 7-8-0 to Rs. 30 per thousand.	3	
3. The Northern India Tobacco Company, Lahore.	Daily production is about 4,000 cigarettes and are sold at rates varying from Rs. 7-8-0 to Rs. 30 per thousand.	3	
4. Phagoo Ram, Anarkali, Lahore.	Average daily production is 1,800 cigarettes, and prices at Rs. 10 per thousand.	2	

(f) There is no further information of particular interest regarding these factories as they have very recently been established.

(g) Information regarding the production of cigarettes by cottage workers has been given in (d) above. Factories Nos. 2 to 4 mentioned therein are working on cottage scale.

(h) There has been some increase in recent years.

(i) Tobacco imported from Madras and Mysore is used in the making of cigarettes in this province. Tobacco grown locally is considered unfit for such purposes on account of the thickness of its leaves. No instances are known where tobacco has been mixed with foreign stuff in the manufacture of cigarettes.

Further information on the subject will follow.

COPY OF A LETTER FROM THE DIRECTOR OF INDUSTRIES, PUNJAB, LAHORE, TO THE DIRECTOR-GENERAL OF COMMERCIAL INTELLIGENCE AND STATISTICS, CALCUTTA, No. 10526, DATED THE 20TH NOVEMBER 1931.

In continuation of my letter No. 9350, dated the 21st October 1931, I have the honour to supply the following additional information :—

(b) and (c). The International Tobacco Corporation, Govind Mahal, Amritsar, is another power-driven Cigarette factory in addition to the one already reported.

The following concerns engaged in the manufacture (i) of cigarettes and (ii) of snuff employ hand labour only :—

(i) The Unique Swadeshi Tobacco Company, 41, Civil Lines, Lawrence Road, Amritsar.

(ii) *Snuff Factories*—

1. Pandit Tirath Ram Lal Chand, Hazro.
2. Lala Thakar Das Nathu Mal, Hazro.
3. Lala Parma Nand Devi Ditta, Hazro.
4. Bhai Bhag Singh Santokh Singh, Hazro.
5. Lala Devi Ditta Hira Nand, Hazro.
6. Lala Jita Mal Jawal Mal Pawa, Hazro.
7. Lala Gopi Chand Jit Singh, Hazro.
8. Lala Narain Das Amar Singh, Hazro.
9. Rai Sahib Lala Gokal Shah, Hazro.
10. Bhai Kishan Singh Dhian Singh, Hazro.
11. Lala Gokal Mal Hans Raj, Hazro.
12. Lala Gokal Chand Hem Raj, Hazro.
13. Pandit Tirath Ram Uttam Chand, Hazro.
14. Sardar Ram Singh Kathuri, Hazro.

Cigars are nowhere manufactured in this province.

(d) and (e). The following statement gives the production and value of each of the concerns mentioned above :—

Name of factory.	Production.	Average number of persons employed.	Remarks.
I.—			
1. The International Tobacco Corporation, Govind Mahal, Amritsar.	2,00,000 cigarettes per day of 8 working hours of the value of Rs. 300, weight 500 to 600 lbs.	59	
2. The Unique Swadeshi Tobacco Company, 41, Civil Lines, Lawrence Road, Amritsar.	This factory manufactures about 15,00,000 cigarettes—1,50,000 packets—3,000 boxes valued at Rs. 9,000 per annum. The approximate weight of these cigarettes 5,000 lbs.	10	

II—

- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. Pandit Tirath Ram Lal Chand, Hazro.</li> <li>2. L. Thakar Das Nathu Mal, Hazro.</li> <li>3. L. Parma Nand Devi Ditta, Hazro.</li> <li>4. Bhai Bhag Singh Santokh Singh, Hazro.</li> <li>5. L. Devi Ditta Hira Nand, Hazro.</li> <li>6. L. Jita Mal Jawal Mal Pawa, Hazro.</li> <li>7. L. Gopi Chand Jit Singh, Hazro.</li> <li>8. R. S. L. Gokal Shah, Hazro.</li> </ol> | } 10-30 workmen in each factory.   |
| <ol style="list-style-type: none"> <li>9. L. Narain Das Amar Singh, Hazro.</li> <li>10. Ehai Kishan Singh Dhian Singh, Hazro.</li> <li>11. L. Gokal Mal Hans Raj, Hazro.</li> <li>12. L. Gokal Chand Hem Raj, Hazro.</li> <li>13. Pandit Tirath Ram Uttam Chand, Hazro.</li> <li>14. S. Ram Singh Kathuri, Hazro.</li> </ol>   | } The total output of snuff at Hazro is about 24,000 maunds value at Rs. 12,00,000 per annum. The manufacture of snuff has decreased to a great extent, as the Kashmir and Bahawalpur States have increased their import duty on this commodity. Many snuff manufacturers have migrated there and manufacture snuff by importing tobacco from Hazro. |

(f) There is no further information of particular interest regarding these factories.

(g) Detailed information regarding the production of cigarettes and snuff has been given above.

(h) There has been a considerable decrease in the production of snuff during the last ten years.

(i) Tobacco used in the factories manufacturing cigarettes is imported from Guntur in the Madras Presidency, Kukra a Railway Station on the Rohilkhand and Kumaon Railway and Nadiad in Gujarat, Kathiawar. The factories manufacturing snuff use chiefly Hazro tobacco. This is a cottage industry.

Statement received from the Director-General of Commercial Intelligence and Statistics with his demi-official letter  
No. 4890-C.I.E., dated 27th July 1931,

Exports of Tobacco (manufactured and unmanufactured) from British India.

Articles.	Quantity.				Value.			
	1927-28.	1928-29.	1929-30.	1930-31.	1927-28.	1928-29.	1929-30.	1930-31.
	Lbs.	Lbs.	Lbs.	Lbs.	Rs.	Rs.	Rs.	Rs.
<b>Tobacco—</b>								
Unmanufactured ..	28,087,669	32,932,102	25,972,767	27,970,510	98,57,840	1,22,61,802	99,48,397	96,72,541
<b>Manufactured—</b>								
Cigars .. ..	281,502	260,370	280,604	219,762	3,01,319	2,85,808	2,98,724	2,45,666
Cigarettes .. ..	288,155	284,077	292,910	342,087	2,98,218	2,69,739	2,79,860	3,16,445
Other Sorts .. ..	589,163	422,847	523,075	560,273	1,55,931	1,29,885	1,15,076	1,30,391
<b>Total Tobacco ..</b>	<b>29,246,489</b>	<b>33,899,396</b>	<b>27,069,356</b>	<b>29,092,632</b>	<b>1,06,13,308</b>	<b>1,29,47,034</b>	<b>1,09,42,057</b>	<b>1,03,65,043</b>

Average value of Exports of Tobacco.

Articles.	Average value per cwt.			
	1927-28.	1928-29.	1929-30.	1930-31.
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
Tobacco—				
Unmanufactured .. .. .	39 4 11	41 11 9	42 14 5	38 11 8
Manufactured—				
Cigars .. .. .	119 14 6	122 14 10	119 4 0	125 3 5
Cigarettes .. .. .	115 14 5	106 5 10	107 0 4	103 9 10
Other Sorts.. .. .	29 10 4	34 5 8	24 10 3	26 1 1

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*Statement received from the Director-General of Commercial Intelligence and Statistics with his demi-official letter No. 4890-C.I.E., dated 27th July 1931.*

Imports of Tobacco (manufactured and unmanufactured) into British India from foreign countries by sea.

Articles.	Quantity.				Value.			
	1927-28.	1928-29.	1929-30.	1930-31.	1927-28.	1928-29.	1929-30.	1930-31.
	lbs.	lbs.	lbs.	lbs.	Rs.	Rs.	Rs.	Rs.
<b>Tobacco—</b>								
<b>Unmanufactured ..</b>	3,984,951	6,760,716	4,551,848	1,608,381	32,01,052	57,42,364	39,71,521	14,39,646
<b>Manufactured—</b>								
<b>Cigars .. ..</b>	35,973	34,490	39,553	32,514	2,00,864	1,74,218	1,75,014	1,59,546
<b>Cigarettes .. ..</b>	5,595,966	4,952,083	5,282,965	3,059,692	2,39,96,319	2,00,90,260	2,13,16,574	1,22,48,144
<b>Tobacco for pipes and         cigarettes. .. ..</b>	254,257	217,694	223,253	189,648	15,16,088	13,15,435	13,56,941	10,88,627
<b>Other Sorts .. ..</b>	56,898	29,589	32,991	39,752	2,18,023	1,37,251	1,50,940	1,79,846
<b>Total Tobacco ..</b>	9,928,045	11,994,572	10,130,610	4,929,987	2,91,32,346	2,74,59,528	2,69,70,990	1,51,15,809



Average value of Imports of Tobacco.

Articles.	Average value per cwt.			
	1927-28.	1928-29.	1929-30.	1930-31.
	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
<b>Tobacco—</b>				
<b>Unmanufactured</b> .. .. .	89 14 5	95 2 1	97 11 7	100 3 11
<b>Manufactured—</b>				
<b>Cigars</b> .. .. .	625 10 11	565 10 4	495 12 8	550 2 6
<b>Cigarettes</b> .. .. .	489 0 2	454 6 5	451 14 8	448 5 5
<b>Tobacco for pipes and cigarettes</b> .. .. .	667 14 1	676 10 9	712 10 10	643 0 3
<b>Other Sorts..</b> .. .. .	429 2 10	519 15 7	512 5 5	506 9 9

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## APPENDIX XXII

## SUBJECT No. 23.

## THE MARKETING OF AGRICULTURAL PRODUCE.

In their chapter on Communications and Marketing, the Royal Commission on Agriculture in India drew attention to the economic loss which occurs through ineffective marketing and made the following definite recommendations :—

- (24) Apart from the organisation of producers for the sale of produce, the most effective means of eliminating unnecessary middlemen are the provision of good roads and the establishment of well regulated markets, easy of access to the cultivator.
- (25) The establishment in all provinces of regulated markets on the Berar system as modified by the Bombay legislation is recommended.
- (26) The system of regulated markets should be extended to products other than cotton.
- (27) Regulated markets should only be established under provincial legislation.
- (28) Local governments should take the initiative in establishing regulated markets and such markets should be established immediately in a few suitable centres.
- (29) The initial expenditure on land and buildings incurred in starting such markets should be met from a loan from provincial revenues.
- (30) The relationship of a regulated market to the council of any municipality or to the local board in the area in which it is established will require careful consideration in drafting the necessary legislation.
- (31) Suggestions are made in regard to the personnel of the market committee.
- (32) Machinery should be provided for the settlement of disputes arising in regulated markets. This should take the form of a board of arbitrators.
- (33) Amongst the duties of the market committee should be that of placing marketing information in a suitable form at the disposal of users of the market.
- (34) Action should be taken to prevent brokers in a regulated market from acting for both buyers and sellers.
- (35) Storage accommodation on a limited scale should be provided in regulated markets.
- (36) Suggestions are made for the utilisation of regulated markets for purposes of propaganda in favour of agricultural improvement and of thrift.

It is of interest to review briefly the progress which has taken place since the Royal Commission reported and to see what outstanding difficulties if any, prevent progress in particular areas.

2. The Bombay Cotton Markets Act, 1927, to which reference is made in the Royal Commission's report, became operative with the publication of the

statutory rules in 1929. A new regulated market under the Act has been established at Dhulia and the first year's report of the Market Committee (Enclosure I) shows that, on the whole, it has been successful. An outstanding feature was the provision for the proper settlement, hearing of complaints by cultivators and other sellers; 167 disputes were settled by the Market Superintendent and 8 by the Disputes Sub-Committee. The size of the market will be gathered from the fact that approximately 34,000 cartloads of Kapas and Cotton mainly the former were dealt with during the season.

3. In the Holkar State, regulated markets for cotton have been steadily developed during the past 3 years or so, and it was reported recently that five markets were working successfully.

4. In Berar, which has always been a pioneer in this matter, the rules made under the Berar Cotton Markets Law of 1897, were revised in 1931, so as to bring them more generally into accordance with the recommendations of the Royal Commission on Agriculture and of the Indian Central Cotton Committee. One important change made is that half the members of the Marketing Committee are now elected by the cotton growers of the area served by the market.

5. In the Central Provinces (proper), open cotton markets have existed for many years. These have been established under the Municipal Act, but, as this fact was found to lead to difficulties in introducing modern improvements and that, on the whole, the system was inferior to that prevailing in Berar, a private member's bill has recently been introduced in the provincial legislative council for the establishment of cotton markets on the lines of those in Berar and Bombay.

6. In Madras, lack of the necessary legislative sanction delayed the establishment of regulated markets for cotton and other produce for some years. Recently a "Bill to provide for the establishment and better regulation of markets for commercial crops in the Presidency of Madras" (Enclosure II), has been introduced. This bill follows the principle recommended by the Royal Commission of extending the system of regulated markets to all commercial crops.

7. The recommendations of the Royal Commission were examined by all provincial governments. In the United Provinces a market survey was considered the first necessity and in Burma the committee appointed to enquire into conditions of "rice and paddy trade" was asked to advise the Local Government on the Royal Commission's recommendations.

8. In Bihar and Orissa, the Commission's recommendations were found inapplicable to conditions obtaining in that province. At the Simla Conference, 1928, it was pointed out that the vested rights of the proprietors of existing markets under the permanent settlement stood in the way of taking such action as the Royal Commission recommended. It is an essential feature of the scheme for regulated markets on Berar and Bombay lines that unauthorised markets within a certain radius of the regulated market should be prohibited. In Bihar, 95 per cent. of the markets in *semindari* areas belonging to the proprietors of the land and the profits arising from them, were taken into account at the time of the permanent settlement, a fact which renders prohibition of unregulated markets well-nigh impossible. The difficulty described applies to other permanently settled tracts, and to some extent to all *semindari* tracts, so that where that form of land tenure prevails, a modification of the regulated markets scheme seems called for. The solution, undoubtedly, lies in the direction of legislation to permit of the regulation of the conditions of trading in particular commodities in all markets instead of the regulation of the management of the markets themselves. There is scope here for careful economic investigation.

9. In paragraph 427 of their report dealing with the value of provincial boards of economic enquiry, the Royal Commission drew attention to the success of economic studies conducted by this agency in the Punjab. In the United Provinces the newly constituted board has taken up the study of certain questions connected with the marketing of agricultural produce.

10. While it is satisfactory to be able to record that a certain amount of progress has been made in the organisation of markets, it has to be admitted that progress is much too slow. The Central Banking Enquiry Committee has made a number of important and far-reaching recommendations which should assist in the finance and marketing of the produce of the country on the wholesale scale. Their recommendations for the creation of licensed warehouse, in particular, may prove of great value to the cultivator. But it is not possible to discuss these proposals apart from the financial structure on which they are to be based; meantime there is great scope for the improvement of the primary markets where the cultivator sells his produce. The effect of present low prices for agricultural produce would be considerably mitigated if the wastage due to inefficient marketing were reduced.

11. The subject is therefore placed before the Advisory Board for consideration whether, and in what manner, the Imperial Council of Agricultural Research can take the initiative in assisting in the more rapid development of better primary markets for agricultural produce in India.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

*Dated the 6th January, 1932.*

#### ENCLOSURE I

##### ANNUAL REPORT OF THE DHULIA COTTON MARKET FOR THE YEAR 1930-31,

*Introduction.*—For a long time, the Government of Bombay had in view the establishment of a regulated Cotton Market to be run on lines similar to those in the Berars but with certain improvements. The Cotton Market Act was accordingly passed in 1927 and rules thereunder were framed in 1929. In February 1928, the Dhulia Taluka Development Association passed a resolution requesting local bodies, *viz.*, the District Local Board and the Dhulia Municipality to move Government to apply the Act to Dhulia. The District Local Board, West Khandesh, passed a resolution accordingly on 11th September 1928. The Dhulia Municipality also followed suit. In addition, the leading trade members, Gulabchand Shet and the late Kashinath Shet showed considerable enthusiasm in making repeated requests for a well organised and regulated market for Dhulia. The Market Yard (7 acres and 31 gunthas) was offered at a nominal rent and free of altered assessment for a period of three years by Mr. Colabawalla and Penkar and the Manmad Manufacturing Company. As a result of this ready response from the local factory owners, merchants, agriculturists and Local Authorities, Government selected Dhulia as the first place best suited for the organization and conduct for a regulated cotton market.

It was first intended to commence the operations of the Act at the commencement of the season, *viz.*, early in October but owing to delay in the publication of the names of the members of the Committee—elected as well as nominated—and in the decision of other questions, the Committee could not meet till 30th September 1930.

*Members.*—The following members constituted the first Cotton Market Committee, for the triennial period ending August 1933 :—

*Cotton growers.*

1. Mr. Uttamrao Bhilajirao Deshmukh, Morana (Taluka Dhulia).
2. Mr. Sampatrao Ganpatrao Patil, Mukti, (Taluka Dhulia).
3. Mr. Tikaram Kashiram Patil, Bhadna (Taluka Sakri).
4. Mr. Lahu Chimnaji Patil, Virdel (Taluka Sindkheda).
5. Mr. Govindrao Zaga Patil, Dhulia.
6. Mr. Jairam Krishna Patil, Ghodada (Taluka Sakri).
7. Mr. Yashavantrao Dalpat Patil, Varshi (Taluka Sindkheda).

*Cotton Traders.*

8. Mr. J. P. Tarapore, B.A.,
9. Mr. Gulabchand Hiralal Shet,
10. Mr. Chandrabhan Nandram Shet,
11. Mr. Chunilal Maganlal Shet.

*Representatives of Local Bodies.*

12. Mr. Motiram Kadu Patil (District Local Board)—From 1st October to 29th June 1931, and  
Mr. Dipchand Sapadu Patil, from 30th June onwards,
13. Mr. Ganpatrao Moghaji Varade (Dhulia Municipality).

*Government Nominee.*

14. Mr. S. H. Prayag, M. Ag., Cotton Breeder, Khandesh, Dhulia, (Mr. S. H. Prayag was elected Chairman for the year. During his absence on leave for a month and a half Mr. Govindrao Zaga Patil held the office of Chairmanship).

The following were other office-bearers for the year 1930-31 appointed by the Committee for the conduct of market business.

*Controlling Sub-Committee.*

1. Mr. S. H. Prayag.
2. Mr. J. P. Tarapore.
3. Mr. Uttamrao Bhilajirao Deshmukh.

*Disputes Sub-Committee.*

1. Mr. J. P. Tarapore.
2. Mr. Govindrao Zaga Patil.
3. Mr. G. M. Varade.

*Auditors.*

1. Mr. G. M. Varade,
2. Mr. Govindrao Zaga Patil.

*Vice-Chairman.*—Mr. Ganpatrao Moghaji Varade remained as Vice-Chairman till 21st April 1931, when Mr. Govindrao Zaga Patil took his place as Mr. G. M. Varade ceased to be on this seat owing to re-election of the members in the Municipality.

*Working of the regulated market and difficulties encountered.*—In the beginning, the Committee experienced considerable difficulties. A large section of the cotton merchants though in favour of the application of the Act to Dhulia, desired to postpone it till the next year for reasons of trade depression and dislocation of traffic in general due to mass Civil Disobedience Movement. Attempts were made to approach the Collector for its postponement and to move the Dhulia Municipality to send a resolution of postponement. But as the Committee had already started its work and had begun its sittings to frame the bye-laws, it was considered undesirable to postpone the working.

As the Committee had to start its work without the necessary funds, Government was approached for a loan of Rs. 5,000. To avoid delay, Government in their resolution (G. R. R. D. No. 374|28, dated 5th November 1930) immediately sanctioned an advance of Rs. 3,000 as part of the loan. The bye-laws had to be framed as the Committee could not function without these. In this, the Committee received considerable help from the late Rao Saheb K. M. Pawar (whose untimely death, the Committee so deeply mourns). These bye-laws were submitted on 13th October 1930 to the Commissioner, C. D., Poona, who was kind enough to give his immediate sanction.

It was at first announced that the market was to be opened on 27th November 1930, at the hands of the Commissioner, C. D., Poona. This was resented by the cotton merchants and "Hartal" was declared. The trouble assumed a serious form paralysing the trade for some time, the market being closed for five days. Wiser counsels soon prevailed and the situation was reconciled by an amicable agreement between the cotton traders and growers. The market was opened on 1st December 1930. The delay in the opening of the market by a month and a half after the season had commenced caused some inconvenience to the strict adherence of some of the rules—licenses had to be given to weighmen who had already been engaged by the cotton traders; open bidding could not be brought into force for some time; the cotton could not be graded and valued separately owing to the mixed nature of the cotton brought into the market. Emergency meetings had to be held and certain modifications in the bye-laws had to be made. With the opening of the regulated market, there were indications of slight reduction in the rates offered for seed cotton, owing to the disallowance of all unauthorised trade allowances to which the traders were accustomed. This had a temporary set-back on the trade; some of the seed cotton carts that had come or should have come to Dhulia market, were found going to Amalner market, in the hope of getting higher rates. In order to impress on the minds of cotton growers the benefits arising out of such regulated markets, a vigorous propaganda had to be undertaken.

*Propaganda work.*—A leaflet showing the benefits to be derived from regulated market was at first printed and a thousand copies were distributed in the area that served the Dhulia Cotton Market, viz., three talukas of Dhulia, Sakri and Sindkheda. A dozen magic lantern slides showing the aims and

objects of regulated markets were prepared and lectures with the help of these were delivered at the following important centres :—

(1) Kusumba,	(9) Chimthana,
(2) Wani,	(10) Sindkheda,
(3) Arvi,	(11) Chanda,
(4) Songir,	(12) Shirud,
(5) Mukti.	(13) Borkund,
(6) Nyahalod,	(14) Vinehur,
(7) Nardana,	(15) Mordad.
(8) Dondsicha,	

In addition, an officer of the Agricultural Department visited the gunnery every day for about 20 days to watch the progress, to settle the disputes and to make the necessary suggestions. Some enlightened cultivators and few representatives of the growers spread the knowledge of the obvious benefits of such a market among the illiterate and ignorant cotton growers both in the market yard and in the mofusil. All this had the desired salutary effect.

The total number of carts—seed cotton and lint—that entered the market from 1st December were as follows :—

Kind of Cotton.	No. of carts.
Seed-cotton .. .. .	32,522
Lint .. .. .	1,296
Cotton waste (low grade cotton) .. .. .	96

*Statement of receipts and expenditure.*—See table enclosed.

*Staff engaged.*—The following was the staff engaged during the year :—

Serial No.	Designation.	Pay.	Allowance.	Remarks.
		Ra. Per mensem.	Ra. Per mensem.	
1	Superintendent .. .. .	100	10	Permanent.
2	Clerk .. .. .	25	..	"
3	" .. .. .	25	..	Temporary
4	Gateman .. .. .	17	..	"
5	" .. .. .	17	..	"
6	" .. .. .	17	..	"
7	" .. .. .	17	..	"
8	" .. .. .	17	..	"
9	Peon .. .. .	16	..	Permanent.
10	Night watchman .. .. .	15	..	Temporary.
11	" .. .. .	15	..	"
12	Sweeper .. .. .	10	..	"

*Meetings.*—The first meeting was held on 30th September 1930. As the bye-laws had to be framed, the number of general Committee and Sub-Committee meetings held in October and November 1930 were frequent, there being in all 10 meetings during the course of two months. Emergency meetings were also held on 27th November and 8th December to settle certain vital issues. The total number of meetings in all was twenty-two. There was no occasion on which a meeting had to be postponed for want of a quorum.

*Benefits derived.*—The first outstanding feature of this market which seems to have appealed to the cotton grower is the provision for the hearing of his complaints by the Market Superintendent and by the Disputes Sub-Committee.

In the unregulated market the grower is entirely at the mercy of the trader. Since first December, 167 disputes were settled by the Superintendent and 8 by the Disputes Sub-Committee. Though the task entrusted to this Committee was arduous, it is a matter of gratification to note that this Committee was able to settle the disputes to the satisfaction of both the parties and in no case was their decision set aside. The grower finds that he is given a squarer deal than what he would have got before. The other benefits obtained by the grower can be summed up as follows :—

- (1) Facilities for the stay of carts during odd hours.
- (2) Safety of cotton carts from theft.
- (3) Announcement of daily cotton prices.
- (4) Regularity and control of fees levied by cotton traders, *viz.*, Adat Panjarapole, etc.
- (5) Correct weighment.
- (6) No unauthorised deductions in weight and no other trade allowances except those included in the bye-laws.
- (7) Proper value for the quality of cotton.

The above does not represent all that can be desired. There are still many defects and long established abuses which have yet to be overcome. Disputes arise as regards the deductions in rates or allowances to be given in cases of cotton containing earth, sand or moisture and formula is to be developed and is before the consideration of the Committee for settling these difficult questions. A good deal of improvement is, therefore, necessary before the benefits of such a market may well be realised. To effectively carry this out, alterations and modifications in the existing rules and bye-laws are also necessary and the Committee has approached the authorities concerned for the necessary changes. It is hoped that most of the defects will be remedied in the course of a year or two.

*Visitors.*—During the year the gentlemen who had been specially deputed by the authorities concerned to pay their visits to this market, were (1) Mr. S. S. Salimath, B. Ag., Deputy Director of Agriculture, S. D., Dharwar, (2) Mr. V. V. Gadgil, B. Ag., Deputy Director of Agriculture, Konkan, Ratnagiri, (3) Mr Syed Ali Husain, B.A., L.T., deputed from the Managing Director, Bombay Provincial Bank. All of them expressed their satisfaction for a good beginning made in the initial stage of such a regulated market.

*Conclusions.*—It is a matter of gratification to note that the market on the whole, has come out successfully through a period of unprecedented strain and though it had to face opposition from the cotton traders in the beginning, the Committee received hearty co-operation from them after the starting of the market. In the working of the Committee every help was given by all the officers of the Revenue and Agricultural Departments. The Committee is very much thankful to the Commissioner, C. D., and the Collector of West Khandesh, for the prompt assistance rendered to the Committee in the matter of advance which the Committee so badly needed in its initial stage of working. The Committee also feels very grateful to Mr. C. G. Marathe, Huzur Deputy Collector, Dhulia, for the valuable help rendered by him in the framing of the bye-laws and in the modifications and amendments to the rules and bye-laws and in guiding the meeting properly.

In the conduct and discharge of my work, I am glad to report that I received the hearty co-operation of all the members of the Committee and especially those of the Disputes Sub-Committee, *viz.*, Messrs. Tarapore, Ganpatrao Varade and Govindrao Patil. Among the staff, Mr. Y. V. Salunkhe deserves special mention for the zeal and enthusiasm he put into the work by daily



attending the factories and by settling the disputes on the spot. Mr. Lalsing Patil also deserves praise for his hard work.

Dhulia may well be proud of being the pioneer in the opening of a regulated market in the Bombay Presidency and especially at a time when the economic depression was very great. It is hoped other markets will soon come under the regulations and make trade smooth and free from abuses.

S. H. PRAYAG,

*Chairman,*

*Cotton Market Committee, Dhulia.*

DHULIA,

The 1st September 1931.

*Cotton Market Committee, Dhulia.*

Statement showing receipts and expenditure during the year 1930-31 (from 12th October 1930 to 31st August 1931).

Receipts.			Expenditure.		
	Rs.	A. P.		Rs.	A. P.
1. Market cess .. ..	4,563	3 0	1. Establishment ..	1,849	13 0
2. Registration and License fee.	2,855	12 0	2. Registration and License (refund).	711	8 0
3. Ground rent .. ..	97	8 0	3. Postage and tele-gram.	401	15 6
4. Miscellaneous .. ..	296	0 0	4. Ground rent .. ..	15	0 0
5. Printing .. ..	132	0 0	5. Miscellaneous .. ..	304	11 6
6. Badges .. ..	25	2 0	6. Lighting .. ..	171	13 6
7. Postage and telegrams ..	45	4 0	7. Printing .. ..	680	12 0
8. Lighting .. ..	1	8 0	8. Badges .. ..	303	8 0
9. Municipal tax, etc. ..	3	2 6	9. Building .. ..	4,392	2 9
10. Commission .. ..	1	5 6	10. Furniture.. ..	274	6 0
11. Government advance ..	2,000	0 0	11. Municipal water tax, etc.	39	9 6
12. Disputes Sub-Committee's fee.	2	0 0	12. Stationery .. ..	78	13 9
13. Travelling allowance (refund).	0	6 0	13. Travelling allowance to members.	240	8 0
			Total expenditure ..	9,464	9 6
			Balance with Urban Bank, Dhulia as under current account ..	Rs. 135	A. P. 3 3
			Saving Bank account ..	340	2 0
			Balance with Mr. Ratanshi Hirji Tarawala, Bombay	25	0 0
			Balance on hand ..	58	4 0
				558	9 6
Total ..	10,023	3 0	Total ..	10,023	3 0
(Sd.) <i>Superintendent, Cotton Market, Dhulia.</i>			(Sd.) S. H. PRAYAG, <i>Chairman, Cotton Market Committee, Dhulia.</i>		

## ENCLOSURE II.

*A Bill to provide for the establishment and the better regulation of markets for commercial crops in the Presidency of Madras.*

*Preamble.*—Whereas it is expedient to provide for the establishment of recognized open markets for the purchase and sale of commercial crops in the Presidency of Madras and for the better regulation of such markets ;

And whereas the previous sanction of the Governor-General has been obtained to the passing of this Act ;

It is hereby enacted as follows :—

1. *Short title.*—(1) This Act may be called the Madras Commercial Crops Markets Act, 19

(2) *Extent.*—It extends to the whole of the Presidency of Madras.

2. *Definitions.*—In this Act, unless there is anything repugnant in the subject or context,

- (i) '*Commercial crop.*'—“Commercial crop” means cotton, groundnut, tobacco or any other crop or grain which the Local Government may, by notification in the *Fort St. George Gazette*, declare to be a commercial crop for the purposes of this Act,
- (ii) '*Grower of a commercial crop.*'—“Grower of a commercial crop” shall not include a dealer or broker in that crop although he may grow that crop. If a question arises as to whether any person is a grower of a commercial crop or not for the purposes of this Act, the decision of the Collector of the district in which the market is situated shall be final ;
- (iii) '*Local body.*'—“Local body” means the Corporation of Madras or a municipal council or a taluk board or a panchayat constituted under any enactment for the time being in force ;
- (iv) '*Market.*'—“Market” means a market established under section 3 ;
- (v) '*Prescribed.*'—“Prescribed” means prescribed by rules or bye-laws made under this Act ; and
- (vi) '*Taluk Board.*'—“Taluk Board” means a Taluk Board constituted under the Madras Local Boards Act, 1920 (Madras Act XIV of 1920), and, where in any part of a district there is no taluk board, the district board constituted under the said Act.

3. *Notification of a market.*—(1) The Local Government may, at the request of or after consulting a local body, by notification in the *Fort St. George Gazette*, establish any place, being the property either of the Local Government or of the local body, as a market under this Act for the purchase and sale of any commercial crop or class of commercial crops specified in such notification.

(2) Every such notification shall define the limits of the market so established, and may, for the purposes of this Act, include within such limits such local area as the Local Government may determine.

4. *No private market to be opened in or near places declared to be markets.*—Wherever the Local Government have, by a notification under section 3, established any place as a market for the purchase and sale of any specified commercial crop or class of commercial crops, no person shall, within the limits of such market or within such distance thereof as may be notified in the

*Fort St. George Gazette* in this behalf by the Local Government, except with the sanction in writing of the Local Government authenticated by the signature of a Secretary to the Local Government and subject to such conditions as may be imposed in such sanction, set up, establish or continue or allow to be continued any place for the purchase and sale of such crop or class of crops.

*Explanation.*—A person shall not be deemed to set up, establish or continue or allow to be continued a place as a place for the purchase and sale of commercial crops within the meaning of this section if he sells his own crops outside the premises set apart by the market committee for such purchase and sale.

5. *The market committee.*—(1) The management and superintendence of every market shall be vested in a market committee. The market committee shall be constituted in such manner as this Local Government may determine and shall consist of not less than twelve and not more than sixteen members. Of these—

- (i) not less than one-half shall be persons elected by the growers of the commercial crop or class of commercial crops in such area as the Local Government may determine ;
- (ii) two shall be nominated by the Local Government ;
- (iii) two shall be elected—
  - (a) by the Corporation of Madras from among its members, in case the market is situated within the city of Madras, or
  - (b) by the municipal council from among its members, in case the market is situated within the municipality, or
  - (c) by the taluk board from among its members, in case the market is situated in a non-panchayat area, or
  - (d) by the panchayat from among its members, in case the market is situated in a panchayat area, or
  - (e) by the members of the local bodies concerned from among themselves in case the market is situated within the jurisdiction of more than one local body ; and
- (iv) the remainder shall be elected by the traders in the market in such manner as the Local Government may determine.

Provided that a member elected in his capacity as a member of a particular local body, shall cease to hold office as member on his ceasing to be a member of the local body by which he was elected.

(2) Every market committee shall elect one of its members to be its chairman.

6. *Market committee to be a body corporate.*—Every market committee shall be a body corporate by such name as the Local Government may specify in the notification establishing it, shall have perpetual succession and a common seal, may sue and be sued in its corporate name, and shall be competent to acquire and hold property, both movable and immovable to lease, sell or otherwise transfer any movable or immovable property which may have become vested in or been acquired by it, and to contract and to do all other things necessary for the purposes for which it is established.

7. *Sub-committee and joint committees and delegation of powers.*—The market committee may appoint one or more of its members to be a sub-committee or to be a joint committee for the conduct of any work or to report on

any matter, and may delegate to any one or more of its members such of its own powers or duties as it may think fit.

**8. *Appointments and salaries of servants of the market committee.*—**

(1) Subject to such rules as may be made by the Local Government in this behalf, a market committee may employ such officers and servants as may be necessary for the management of the market, may pay such officers and servants such salaries as it may think fit and shall have power to control and punish them. The Committee may also provide for the payment to its officers and servants of such leave allowances, pensions, gratuities or compassionate allowances as it deems proper ; and may contribute to any provident fund which may be established for the benefit of such officers and servants.

(2) The Committee shall in the case of any officer or servant of Government which it employs, pay Government such contribution towards the pension and leave allowances of such officer or servant as may be payable under the regulations in that behalf in force for the time being.

**9. *Execution of contracts.*—**(1) Every contract entered into by the market committee shall be in writing and shall be signed on behalf of the market committee by the chairman and two other members of the committee.

(2) No contract other than a contract executed as provided in sub-section (1) shall be binding on a market committee.

**10. *Market Committee Funds.*—**(1) All moneys received by a market committee shall be paid into a fund to be called the 'Market Committee Fund' and all expenditure incurred by the market committee under or for the purposes of this Act shall be defrayed out of the said fund ; and any surplus remaining after such expenditure has been met shall be invested in such manner as may be prescribed by rules.

(2) (a) Every market committee shall out of its fund pay to the Local Government the cost of any special or additional staff employed by the Local Government for the purposes of such committee.

(b) The Local Government shall determine the cost of such special or additional staff and shall, where the staff is employed for the purposes of more than one market committee, apportion such cost among the committees concerned in such manner as they think fit. The decision of the Local Government determining the amount payable by any market committee shall be final.

**11. *Purposes for which the market committee fund may be expended.*—** Subject to the provisions of section 10 the market committee fund shall be expended for the following purposes only :—

- (i) the maintenance and improvement of the market ;
- (ii) the construction and repair of buildings which are necessary for the purposes of such market and for the health, convenience and safety of the persons using it ;
- (iii) the pay, pensions, leave allowances, gratuities, compassionate allowances and contributions towards leave allowances, pensions or provident fund of the officers and servants employed by the market committee ;
- (iv) the expenses of and incidental to elections ;
- (v) the payment of interest and sinking funds on loans that may be raised for purposes of the market ;

(vi) the dissemination of information regarding all matters relating to marketing ; and

(vii) propaganda in favour of agricultural improvement and thrift.

12. *No trade allowance not recognised by custom or rules allowable.*—No trade allowance, other than an allowance prescribed by rules or bye-laws made under this Act, shall be made or received by any person in any transaction in a market established under this Act, and no Civil Court shall, in any suit or proceeding arising out of any transaction in any such market, have regard to any trade allowance not so prescribed.

*Explanation.*—Every deduction other than deductions on account of deviation from sample, when the purchase is made by sample, or of deviation from standard, when the purchase is made by reference to a known standard or on account of difference between the actual weight of the sacking and the standard weight ; or on account of the admixture of foreign matter, shall be regarded as a trade allowance for the purposes of this Act.

13. *Power to borrow.*—(1) Every market committee may, with the previous sanction of the Local Government, raise the money required for carrying out the purposes for which it is established on the security of any property vested in and belonging to the market committee, and of any fees leviable by the market committee, under this Act. The Committee may, for the purpose of meeting the initial expenditure on lands, buildings and equipment required for establishing the market, obtain a loan from the Local Government.

(2) The conditions under which such money or loan shall be raised and the time within which the same shall be repayable shall be subject to the previous sanction of the Local Government.

14. *Supersession of market committees.*—(1) If, in their opinion, a market committee is not competent to perform or persistently makes default in performing the duties imposed on it by or under this Act, or exceeds or abuses its powers, the Local Government may, by notification in the *Fort St. George Gazette*, supersede such committee.

(2) Upon the publication of a notification under sub-section (1) superseding a market committee, the following consequences shall ensue :—

(a) all the members as well as the chairman of the market committee shall, as from the date of such publication, be deemed to have vacated their offices ;

(b) the Local Government may, at their discretion, by order, either constitute a new committee under section 5 or make such arrangements for the carrying out of the functions of the committee, as the Local Government may think fit ; and

(c) all the assets vested in the committee shall, subject to all its liabilities vest in the Local Government.

(3) (a) If the Local Government make an order under clause (b) of sub-section (2), they shall transfer the assets and liabilities of the market committee, as on the date of such transfer, to the new committee constituted under section 5 or to the person or persons, if any, appointed for carrying out the functions of the committee, as the case may be.

(b) If the Local Government do not make such an order, they shall transfer all the assets of the market committee which remain after the satisfaction of all its liabilities, to the local body within whose jurisdiction the market committee

is situated, or if there is more than one such local body, to each of such bodies in such proportion as the Local Government may determine.

(c) Any local body to which any assets have been transferred under clause (b) shall employ such assets for any object of public utility in the area within its jurisdiction.

15. *Penalties.*—Whoever contravenes the provisions of section 4 shall be punishable with fine which may extend to five hundred rupees, and in the case of a continuing contravention with a further fine which may extend to one hundred rupees for every day during which the contravention is continued after conviction therefor.

16. *Rules.*—(1) The Local Government may, either generally or specially for any market or group of markets, make rules consistent with this Act for the management and regulation thereof.

(2) In particular and without prejudice to the generality of the foregoing power such rules may provide for or regulate—

- (i) the election and nomination of members of a market committee, the number of members to be elected by each of the bodies or groups of individuals referred to in section 5 and the manner of election, the preparation and revision of lists of voters from time to time, the payment of all expenditure in connection with or incidental to such election and the term of office of members ;
- (ii) the powers to be exercised by a market committee,
- (iii) the election of the chairman of a market committee and his term of office ;
- (iv) the filling of casual vacancies in the office of chairman or member of a market committee ;
- (v) the management of a market and the prescribing of fees by the market committee and the recovery and disposal of such fees ;
- (vi) the issue by a market committee of licences to brokers, weighmen, measurers, surveyors, warehousemen and other persons using the market, the form in which, and the conditions under which, such licenses shall be issued or renewed, and the fees to be charged therefor ;
- (vii) the place or places at which any commercial crop or class of commercial crops shall be weighed or measured, and the kind and description of the scales, weights and measures to be used at such place or places ;
- (viii) the periodical inspection, verification and correction of all scales, weights and measures in use in a market ;
- (ix) the trade allowances which may be made or received by any person in any transaction in a market ;
- (x) the settlement of any dispute between a buyer and seller of a commercial crop or their agents including disputes regarding the quality or weight of the article, the allowances for wrappings, dirt or impurities or deductions from any cause ;
- (xi) the prohibition of brokers from acting in any transaction on behalf of both the buyer and seller of a commercial crop ;

- (xii) the manner in which auctions shall be conducted and bids made and accepted in any market ;
  - (xiii) the provision of accommodation for storing any commercial crops brought into the market ;
  - (xiv) the preparation of plans and estimates for works proposed to be constructed partly or wholly at the expense of the market committee, and the grant of sanction to such plans and estimates ;
  - (xv) the form in which the accounts of a market committee shall be kept, the audit and publication of such accounts and the charges if any to be made for such audit ;
  - (xvi) the preparation and submission for sanction of an annual budget and the reports and returns to be furnished by a market committee ;
  - (xvii) the disposal of the surplus funds of a market committee ; and
  - (xviii) any special or additional staff to be employed by the Local Government for the purposes of any market committee or committees.
- (3) Any rule made under this section may provide that any contravention thereof or of any of the conditions of any licence issued or renewed thereunder shall be punishable with fine which may extend to five hundred rupees.
- (4) The power to make rules under this section is subject to the condition that a draft of the rules shall be published in the *Fort St. George Gazette* and that such draft shall not be taken into consideration until one month after such publication.
- (5) All rules made under this section shall be published in the *Fort St. George Gazette* and upon such publication shall have effect as if enacted in this Act.

17. *Bye-laws.*—(1) Subject to any rules made by the Local Government under section 16 and with the previous sanction of the Collector, a market committee may in respect of the market under its management make bye-laws for the regulation of the business and the conditions of trading therein.

(2) Any bye-law made under this section may provide that contravention thereof shall be punishable with fine which may extend to fifty rupees.

18. *Trial of offences.*—(1) No offence made punishable by this Act or any rule or bye-law made thereunder shall be tried by a court inferior to that of a Presidency Magistrate or a Magistrate of the first class.

(2) Prosecutions under this Act may be instituted by any person duly authorized in writing by the market committee in this behalf.

(3) All fines recovered from an offender shall be credited to provincial revenues and a grant equivalent to such fines shall be paid to the market committee in the following financial year.

19. *Recovery of sums due to Government from market committee.*—All sums due from a market committee to the Local Government may be recovered in the same manner as arrears of land revenue.

20. *Delegation of Collector's powers.*—With the previous sanction of the Local Government which may be accorded by general or special order, the Collector may, by an order in writing, delegate to any revenue officer not below the rank of a Deputy Tahsildar all or any of his powers or duties under this Act or the rules framed thereunder.

*Statement of Objects and Reasons.*

The Indian Cotton Committee of 1917-18 drew attention to the necessity of better provision for the marketing of cotton and *kapas* by growers, and pointed out the advantages of the Berar system of cotton markets as leading to better prices, fairer weighments and the prevention of illegal deductions. They held that the establishment of open cotton markets of this nature would benefit the grower and indirectly the cotton trade generally. In 1919 the Tiruppur Municipal Council, at the instance of the Coimbatore Cotton Marketing Association, wanted to establish a cotton market at Tiruppur on the lines of the Berar markets. The Council built some of the buildings required for the purpose and framed a set of bye-laws on the lines of the Berar Cotton and Grain Markets Law of 1897 and the rules made thereunder. But these bye-laws could not be approved by Government owing to want of proper legislative sanction and the scheme fell through. The Royal Commission on Agriculture has now recommended that in all provinces regulated markets should be established on the Berar system as modified by the Bombay legislation (Bombay Cotton Markets Act, 1927), that the system of regulated markets should be extended to products other than cotton, *e.g.*, grain, oilseeds, etc., and that regulated markets should only be established under special provincial legislation.

2. The present Bill, which is purely an enabling measure, is based on the recommendations of the Royal Commission on Agriculture and the Bombay Cotton Markets Act, 1927. The Bill applies to the whole of the Presidency of Madras. By clause 3 power is taken to notify any place as a market for the sale of all or any commercial crops, the notification defining the limits of such market. Commercial crop has been defined to mean cotton, groundnut, tobacco and any other crop or grain which the Local Government may by notification in the *Fort St. George Gazette* declare to be a commercial crop. Provision has also been made for local opinion being consulted before a market is established. On the establishment of a market a market committee is to be constituted including representatives of the growers of the commercial crop of the trade and of the local authority within whose jurisdiction the market is situated. Provision is to be made by rules for the composition of the market committee, the management of the market and the conduct of the affairs of the market by the committee; and the market committee is empowered to make bye-laws to regulate business and the conditions of trading. Under clause 4 no private market for the purchase and sale of any commercial crop may be opened in or near places declared to be a market. Provision has also been made for disallowing trade allowances other than prescribed trade allowances and for penalties for violation of the substantive provisions of the Act, rules and bye-laws. Clause 14 states when a market committee may be superseded and the consequences of its supersession.



## APPENDIX XXIII

SUBJECT No. 24.

SCHEME FOR THE IMPROVEMENT OF CASTOR CROP IN INDIA  
SUBMITTED BY THE GOVERNMENT OF HIS EXALTED HIGHNESS  
THE NIZAM (REPORT OF COMMITTEE).

At its meeting held in June 1931 the Advisory Board considered a scheme (Enclosure I) for the improvement of castor crop in India submitted by the Government of His Exalted Highness the Nizam and decided (Enclosure II) that it should be examined by a Committee consisting of the following with a view to amending it in the light of such experience as had been gained in Bombay and elsewhere :—

1. Diwan Bahadur Sir T. Vijayaraghavacharya, Chairman *ex-officio*.
2. The Agricultural Expert, Imperial Council of Agricultural Research.
3. Dr. W. Burns, Bombay.
4. Mr. R. K. Bhide, Hyderabad.
5. The Oil Seeds Specialist, Madras.
6. Mr. R. L. Sethi, United Provinces.

Mr. M. S. A. Hydari, Secretary *ex-officio*.

2. The Committee met at Bombay on Thursday the 14th January 1932 and a copy of the report submitted by them will be found in Enclosure III. The scheme, as now revised, involves a recurring and a non-recurring expenditure of Ra. 56,300 and Ra. 9,350 respectively or a total of Ra. 65,650 spread over a period of five years, out of which the Imperial Council has been asked to meet half the cost.

The scheme is now for the consideration of the Advisory Board.

M. S. A. HYDARI,

*Secretary.*

*The 18th January 1932.*

## ENCLOSURE I.

LETTER FROM B. A. COLLINS, Esq., C.I.E., I.C.S., DIRECTOR-GENERAL AND SECRETARY TO GOVERNMENT, DEPARTMENT OF COMMERCE AND INDUSTRY, H. E. H. THE NIZAM'S GOVERNMENT, HYDERABAD-DECCAN, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 70-P., DATED THE 7TH DECEMBER 1930.

*Improvement of the castor crop in India.*

I have the honour to forward a note regarding the improvement of the castor crop in India and to request that it may be placed before the Imperial Council of Agricultural Research with a view to a grant being made to assist the development of the work which is already being carried on by H. E. H. the Nizam's Government.

*Introductory Note to the Scheme for the Improvement of the castor crop in India.*

Although castor is not generally regarded as an important major crop a careful study shows that India is a very important supplier of castor oil requirements of the world. The countries which consume the largest quantities of castor seed and castor oil are the United Kingdom and the United States of America. Of the total quantity of castor seed imported into the United Kingdom 86 per cent. is supplied by India. Of the total quantity of castor seed imported into the United States of America 88 per cent. is drawn from India. In the matter of the supply of castor oil the British Empire receives 94 per cent. of India's exports, of which 72 per cent. goes to the United Kingdom. That is to say India plays a very important part in the supply of castor and its products to the British Empire and to the world. The value of export from India of castor seed and its products is a little more than a million pounds annually. This is not a very satisfactory figure looking to the fact that an area of about one and a half million acres is put down under the crop every year. The reason of this is low outturns. Average outturn per acre of castor seed in India is 350 lbs., in Ceylon 1,000 lbs., in Egypt 1,000 lbs., in the United States of America 1,100 lbs., and in Queensland 1,300 lbs. This difference between outturns in India and those in other countries indicates that there are great possibilities for improvement. Why should we not obtain three times as much yield as we are getting at present, like other countries ?

Then the amount of oil contained in the seed varies from 34 to 52 per cent. Why should we not get 50 per cent. oil from our seed ?

Yield of seed and its oil content depend on many factors, *viz.*, local conditions, cultural methods and kind of seed. Little can be done to change local conditions. Improving of cultural methods is a simple matter comparatively. But effecting of some improvement in the plant itself is a highly technical matter, which cannot be done but by a fully qualified and equipped botanist. Attempts have, no doubt, been made in the past in some provinces, towards this end. But what is required is serious, systematic and sustained effort, until the result aimed at is achieved.

Where should this work be done ?

The total area under castor in India is about a million and a half acres annually. 55 per cent. of this is in the Hyderabad State, and 21 per cent. in the Madras Presidency. The remainder is shared by all the other provinces. The total outturn of castor seed in India is estimated to be about one hundred and thirty-five thousand tons, 32 per cent. of which is produced in Hyderabad State, 25 per cent. in the Madras Presidency, and 18 per cent. in the Bombay Presidency. The balance belongs to all the other provinces. Thus, it is clear that the Hyderabad State is the most important province in India in the matter of production of castor seed, both in area under the crop and the amount of seed produced.

Hyderabad is, therefore, the most suitable place for carrying on such research. A beginning has already been made, and the Economic Botanist of the State, Mr. R. K. Bhide, a competent expert of considerable experience, has been making selections during the last two years, and the results so far are very promising. He has, up till now, been selecting from the indigenous types found in the State. To obtain such results as will be applicable in other Provinces he will have to collect all the different samples obtainable in the different parts of India, which will mean a very considerable expansion in his work. The lines on

which the work is proposed to be carried out are explained in the scheme already submitted. The application for a grant from this Council is for a (a) Non-recurring Rs. 4,750 and (b) Recurring Rs. 15,892 annually for 5 years, *i.e.*, a total of Rs. 84,210.

N. HYDER,

*Director of Agriculture, Hyderabad.*

*Scheme for the improvement of the castor crop in India.*

The average acreage under castor in H. E. H. the Nizam's Dominions calculated from the last five years' figures is over 600,000 acres. This is believed to be quite 50 per cent. of the acreage under castor in India and a very large proportion of the castor grown in the world. Hyderabad is, therefore, the most appropriate place to work out the improvement of the castor crop. It has the further advantage of possessing two entirely different classes of soil on which castor is grown, *viz.*, the black cotton soils of the Deccan and the light gravelly soils of the southern peninsula. The great bulk of the commercial crop in Hyderabad is grown on the latter soils in the Telugu districts. The outturn per acre is poor, but little is spent on the crop and it brings in a better return than anything else.

2. In view of the importance of the crop to Hyderabad, the Department of Agriculture has already started work on it, and the Economic Botanist has been engaged on this crop for more than two years. Considerable promise of success has already been obtained. Already some individual plants have been selected which though not yet quite pure for all the desirable characters have nevertheless given a good yield of seed with satisfactory oil content, and it is hoped that within a season or two these can be purified and after multiplication the seed may be distributed to cultivators who thereby will get an yield of at least three to four times their present outturn. Although this work will be of great use to cultivators in the surrounding provinces where soils are similar to those of Hyderabad, still there are other parts of India such as the Gangetic valley where the soil conditions are quite different. Hyderabad would, however, be far the best centre in the whole of India for conducting research into this crop, and it will not be difficult to increase the expenditure on the work now in hand to obtain results which would be useful not only to the surrounding provinces but to the whole of the rest of India. It will be necessary first of all to collect as many types of samples of castor as possible from the various parts of British India and also as many of our samples as can be obtained, together with information about the respective conditions of soil, moisture, temperature, manure, trade requirements, etc., and to grow these samples at one of the main farms of the State near Hyderabad. The following breeding and cultural work will also have to be done :—

*Breeding.*—(1) Isolation and subsequent testing of the unit species from the various varieties of castor grown India, *i.e.*, isolation of pure lines for all the possible morphological characters and (2) analysis of the factors which make up yield such as the branching habit, the number of male and female flowers in each spike, etc., etc., (3) study of the variation of oil content from plant to plant in the same pure lines, from spike to spike in the same plant and from seed to seed in the same spike in all the different unit species and (4) study of pollination in castor.

*General.*—(1) Study (largely by pot cultures) of the influence of environmental factors, such as soil moistures, manure-nitrogen, phosphorus air temperature, etc., on the nature of the flowers produced and the yield of seed and oil content obtained; (2) date of sowing trials to determine the best time for sowing and (3) spacing trials to determine the most suitable spacing for different types.

3. This will mean a grant for additional staff and equipment which it would not be justifiable for the Government of Hyderabad to incur for its own purposes. At present, a sum of Rs. 35,935 is being spent annually on the work of the Economic Botanist, apart from the expenditure on, a special Cotton Botanist which is being borne by the Indian Central Cotton Committee. The Economic Botanist has also been provided with the necessary equipment and a laboratory for him is under course of construction. If the work is to be expanded so as to place it on an all-India basis, it will be necessary to incur additional expenditure amounting to Rs. 9,350 non-recurring and Rs. 15,892 recurring. The latter will be the average expenditure over a period of five years which is the least, for which it will be of any use to undertake these investigations. It is difficult to estimate how much exactly is being spent on the castor crop alone by the Hyderabad Government. The Economic Botanist is now working on four crops, but the castor and paddy crops take up much more of his time than his work on wheat and jowar. In the circumstances, it will no doubt be thought that the State Government is already spending a sufficient amount year by year on this work and that the remainder of the sum now required might be borne by the Research Council. Of the non-recurring expenditure, Rs. 4,750 will be required for equipment and a temporary shed which, in accordance with the rules approved by the Governing Body, would be borne by the Research Council and H. E. H. the Nizam's Government will have to be responsible for the balance.

4. It is hoped that in view of the work which H. E. H.'s Government are already undertaking on this crop which is bound to be beneficial to the surrounding provinces in any case, the Agricultural Research Council will be ready to undertake an average liability of Rs. 15,892 for the next five years as well as to meet non-recurring expenditure to the extent of Rs. 4,750.

(Sd.) B. A. COLLINS,

*Director-General of Commerce and Industry,*

*H. E. H. the Nizam's Government.*

*Dated Hyderabad-Deccan,*

*December 7, 1930.*

*Expenditure in connection with the scheme for the improvement of castor crop in India.*

	Non-recurring	Recurring average of 5 years.
	Rs.	Rs.
I. Capital expenditure—		
(a) Additional laboratory accommodation ..	3,000	..
(b) Ideal fencing for 4 acres .. .. .	1,600	..

	Non- recurring. Ra.	Recurring average of 5 years. Ra.
II. Staff—		
(a) Technical assistants. Two for botanical and breeding work each at Rs. 200—20—300 .. .. .	..	6,384
(b) Seven plant collectors at Rs. 40—2—50 each .. .. .	..	3,984
(c) Clerical staff. One clerk and computer at Rs. 80—5—100 .. .. .	..	1,140
(d) Menial staff. 2 peons at Rs. 15 each per mensem .. .. .	..	360
III. Allowances—		
(a) Travelling allowance .. .. .	..	1,200
(b) Conveyance allowance to the staff .. .. .	..	460
IV. Equipment—		
(a) Apparatus .. .. .	2,000	..
(b) Furniture .. .. .	1,000	..
(c) Typewriter .. .. .	750	..
(d) Shed for pot culture .. .. .	1,000	..
(e) Breeding requirements such as selfing bags, seed bins, etc. .. .. .	..	1,200
V. Miscellaneous contingencies .. .. .	..	600
VI. Extra labour .. .. .	..	600
Total ..	9,350	15,892

## ENCLOSURE II.

EXTRACT FROM THE PROCEEDINGS OF THE ADVISORY BOARD, JUNE 1931.

*Application from His Exalted Highness the Nizam's Government for a grant for the improvement of the Castor Crop in India.*—Mr. Nizamuddin Hyder, the Director of Agriculture, Hyderabad, explained the scheme. He said that India was an important supplier of castor oil in the world. She supplied 86 per cent. of the United Kingdom's requirements of castor seed and 88 per cent. of those of the United States of America. The value of the total exports of castor seed and its products from India amounted to about one million pounds sterling per annum. The Nizam's Dominions had 55 per cent. of the acreage under castor in India, the Madras Presidency about 21 per cent. and the rest was divided amongst other provinces in India. Castor was therefore a crop in regard to which further research would yield economic advantages of considerable value and the location of such a scheme of research should appropriately be the Nizam's Dominions which had the largest acreage of castor in India. Mr. Sethi in supporting the scheme suggested that the Crop Botanist, Hyderabad, should, in addition to varietal questions, also take up the problem of disease. It would be worth while developing the castor crop in the Gangetic Plain as castor case was useful for manuring the sugarcane crop. Professor Ganguli said that the Advisory Board ought to know what success had so far been obtained during the

two years' work which the Economic Botanist, Hyderabad, had done on this crop. In the second place, he would like neighbouring provinces such as Madras and Bombay which were also interested in castor cultivation, to join in the scheme. He was not very sure that they would be justified in spending about Ra. 84,000 on an oil seed crop which was the least extensively grown in India. India had lost during the last few years her trade in linseed and sesamum. He thought at the present moment research into these oil seeds might pay better than that in castor. Lastly he was of opinion that the Advisory Board should work out for the information of the Governing Body an order of priority for the various schemes recommended by the Board. Mr. Nizamuddin Hyder explained that some of the strains selected by Mr. Bhide so far are promising in that they have been observed to possess the desirable characters of high yield, early commencement and completion of flowering and excess of female over male flowers. These selections are not quite pure yet, however. It will take a few years before a truly pure type of plant of highly fertilized crop like castor is obtained. Mr. Main said that in Bombay they were doing some work on castor and that it would be advisable for those who would work the Hyderabad scheme to take note of Bombay experience. Dr. Burns, the Economic Botanist, Bombay, had to make in this regard and it would be advisable to refer the scheme which had his general support to a committee. Rao Bahadur Ananda Rao said that the Oil Seed Expert in Madras was engaged on work on groundnuts, cocoanuts and gingelly. These were more important to Madras than castor which was grown chiefly as a border crop but not on a large scale though the area covered by it was considerable. Dr. Agharkar supported the scheme generally but agreed with Mr. Main that it required sifting. Mr. Milne felt that the scheme put up by Hyderabad was difficult to justify and gave the following figures of crop areas grown in India from the "Estimates of Area and Yield of Principal Crops in India, 1928-29" :—

*Rice*.—85,558,000 acres.

*Wheat*.—32,011,000 acres.

*Cotton*.—26,512,000 acres.

and even among oil seeds the figures were—

*Linseed*.—3,124,000 acres.

*Rape and mustard*.—6,878,000 acres.

*Sesamum*.—5,470,000 acres.

*Groundnut*.—6,214,000 acres.

*Castor*.—1,428,000 acres.

In the light of these figures he felt the castor was not the most important even amongst the oil seeds. He was of opinion that the work proposed should be done through a Fellowship or a Research Scholarship costing say Ra. 150—10—200.

The Board was however of opinion that castor research was worthy of support and that the present scheme should be examined by a Committee consisting of the following with a view to amending it in the light of such experience as had been gained in Bombay and elsewhere :—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, *Chairman ex-officio*.
2. The Agricultural Expert to the Council.
3. Dr. BURNS, Bombay.
4. Mr. BHIDE, Hyderabad.

5. The Oil Seeds Specialist, Madras.  
 6. Mr. SETHI, United Provinces,  
 Mr. M. S. A. HYDARI, *Secretary ex-officio*.

ENCLOSURE III.

REPORT OF THE SUB-COMMITTEE APPOINTED TO CONSIDER THE RESEARCH SCHEME FOR THE IMPROVEMENT OF THE CASTOR CROP IN INDIA SUBMITTED BY THE GOVERNMENT OF HIS EXALTED HIGHNESS THE NIZAM.

We are agreed that it is practicable and desirable to aim at the isolation of a group (say 6) of high-yielding varieties of castor. It is presumed that the oil-content will be determined annually and that this may be one of the deciding factors in the final choice of variety. It is hoped that some of the strains isolated will prove suitable for parts of India other than Hyderabad.

2. We agree that the working out of the inheritance of the individual characters which determine the agricultural yield of castor will take more than five years, but, as castor breeding is part of the permanent programme of the Economic Botanist, Hyderabad, this fact presents no special difficulty; indeed such study is essential to the final solution of the problem.

3. An important detail in castor breeding to which we wish to draw attention is the question of the dehiscence of the fruit. Varieties which dehisce too readily cause loss to the cultivator by shedding. On the other hand the oil seed trade believes that easy-splitting fruits are desirable as otherwise soaking in water before hulling is resorted to and this practice leads to heating of the seed and to a high acid value which is objectionable. It is clear therefore that extreme forms should be avoided.

4. We are agreed that a collection of "pure lines" should be isolated, maintained and described and that small quantities of seed of these should be made available to other Botanists in India. Such pure lines are essential to work on the effect of environment on economic characters.

5. *Oil Content*.—The work described under item 3 of the breeding section of the scheme, *vis.*, the study of the variation of oil content can only be undertaken with reasonable prospects of success when the pure lines referred to above are available. This therefore will be a later stage of work. We understand that the Hyderabad Agricultural Department will be in a position to give the necessary chemical assistance.

6. The final testing of the improved strains obtained should be carried out by the most modern methods with adequate replication of plots and critical data which will permit of proper statistical interpretation preferably by Fisher's method.

7. As regards the work described under 'General' we are of opinion that a study of environmental conditions on the ratio of male and female flowers would not be worth while. The effect of environment, *i.e.*, of soil moisture, manure, etc., on oil content is a normal development which must follow the isolation of pure lines. Items 2 and 3, experiments to determine the optimum sowing dates and the optimum spacing will naturally be undertaken as soon as sufficiently homogeneous material is available. Here also modern methods of field experiment and statistical interpretation are essential.

*Budget.*

(1) *Recurring expenditure.*—(a) We approve proposals for technical assistants.

(b) Having regard to the pay of similar posts in Hyderabad and the programme of work we recommend five plant collectors on Rs. 30—2—40 instead of seven on Rs. 40—2—50. We consider that the Hyderabad State should be asked to provide the clerical and menial staff which is required for the general strengthening of the botanical section. We consider that Rs. 3,000 spread over the five-year period is sufficient for travelling allowance, an average of Rs. 600 per annum. We agree to the proposal for conveyance allowance. We agree to the items for breeding requirements, miscellaneous contingencies and extra labour.

(2) *Non-recurring expenditure Rs. 9,350.*—This is mainly made up of buildings, fencing and equipment and we consider that it will be more appropriate if these were provided by the Hyderabad State. The cost of the scheme as now revised is approximately Rs. 11,260 per annum recurring and Rs. 9,350 non-recurring, the total of Rs. 65,650 in round figures. We consider that having regard to the great importance of the castor crop to the Hyderabad State, this scheme should be assisted on a 50 : 50 basis. If our proposals in regard to non-recurring expenditure are accepted, this would involve an annual grant by the Council of approximately Rs. 6,565. We recommend a grant of this amount for a period of five years for research of the nature outlined in this report.

T. VIJAYARAGHAVACHARYA.

B. C. BURT.

W. BURNS.

R. L. SETHI.

R. K. BHIDE.

BOMBAY ;

The 14th January 1932.

*Statement of recurring expenditure as recommended by the Sub-Committee.*

	I year.	II year.	III year.	IV year.	V year.	Total.
II.—Two Technical Assistants, Rs. 200—20—300 ..	4,800	5,280	5,760	6,240	6,720	
Five Plant Collectors, Rs. 30—2—40 ..	1,800	1,920	2,040	2,160	2,280	
III.—Travelling Allowance ..	600	600	600	600	600	
Conveyance Allowance to Staff ..	460	460	460	460	460	
IV (e).—Breeding requirements, etc. ..	1,200	1,200	1,200	1,200	1,200	
V.—Miscellaneous contingencies ..	600	600	600	600	600	
Extra Labour ..	600	600	600	600	600	
Total ..	10,060	10,660	11,260	11,860	12,460	56,300



## APPENDIX XXIV.

SUBJECT No. 29.

APPOINTMENT OF MR. KARTHA FOR SIX MONTHS TO COMPILE STATISTICS SHOWING THE COMPARATIVE EFFICIENCY OF THE DIFFERENT FEEDING SCALES ADOPTED IN THE MILITARY DAIRIES AND OF THE EFFECTS OF DISEASE AND OTHER NECESSARY FACTORS ON DAIRYING EFFICIENCY.

Attention is invited to the attached note by the Animal Husbandry Expert to the Council on the subject mentioned above. The scheme which involves an expenditure of Ra. 1,500, is for the consideration of the Advisory Board.

M. S. A. HYDARI,

*Secretary.*

*The 21st January 1932.*

Towards the end of his appointment as Assistant Controller, Military Dairy Farms, Southern Circle, Colonel Matson, realising the importance of a precise statistical study of the comparative efficiency of the different feeding scales which have been adopted from time to time in the military dairies, and of the effects of disease and other accessory factors on dairying efficiency, employed a statistician, for over a year, at his own expense. During that time statistics were compiled from the records of the Military Dairy Farms of the Southern Circle, which have an average of about 800 cows and buffaloes constantly in milk. Besides going into the economics of milk production he also obtained figures showing the results which have been obtained in grading up pure Indian breeds for milk production, and of the comparative effect of contagious abortion among Indian and half-bred cows. As the work was not complete when Colonel Matson left India, about 6 months ago, the Military Dairy Farms recognizing its importance, employed Mr. Kartha, the statistician who had been doing the work for Colonel Matson, for a further 6 months. The Military Dairy Farms however, have no funds for research work of this kind and they were compelled to dispense with his services, some 6 months ago, while there was still much to be done to carry out a thorough examination of the large mass of figures available. Precise information of this kind is very much required by the dairying industry in India, for instance, as to the most efficient system of feeding and the starch equivalents required for buffaloes and other milch cattle, and I think it is a matter of considerable importance that the work already done should be completed and published. I, therefore, propose that Mr. Kartha, who is a B. A. of the Madras University and, as the result of the work he has been doing for Colonel Matson, is now well acquainted with the records from which the information can be obtained, should be employed for such further period as may be necessary to obtain all the information available.

Having such a large number of milch cattle, constantly under strict control and record, such information could be obtained from Military Dairy Farm records and from no other source in India, and there is no doubt that the cost of obtaining it would be well worth the expense involved.

The particular points on which I propose that Mr. Kartha should obtain statistical data are :—

- (1) The comparative over-all cost of milk and butterfat production from Indian cows,  $\frac{1}{2}$ -bred cows, and buffaloes, respectively, under the different conditions of feeding and management which have existed in these dairies from time to time. Mr. Smith, late Imperial Dairy Expert, was consulted about this and in his reply stated "what the dairy industry wants is accurate figures carefully detailed and properly vouched for".
- (2) To complete the statistical study of the results which have been obtained in the Ferozepore herd in grading up Sahiwal cattle for higher milk yield. This work has already been done up to a certain point but requires to be brought up-to-date, and should supply valuable information as to the results which can be obtained by similar work for other breeds. Incidentally in connection with this work a system of milk recording suitable for Indian conditions could be worked out.
- (3) Colonel Matson also did a great deal of work on the comparative incidence of contagious abortion among Indian and  $\frac{1}{2}$ -bred cows in the Southern Circle. This work could be completed in the Northern Circle while the sheets are being examined for other purposes.

I anticipate that it would take Mr. Kartha at least 6 months to make the necessary compilations while, if any one strange to the work undertook it, a much longer period would be required.

I have ascertained from the Director of Military Dairy Farms that he would afford every facility and that Mr. Kartha could work in the office of the Assistant Controller of Military Dairy Farms of the Northern Circle at Lahore. There will, therefore, be no expense involved in providing office accommodation and the only cost would be the pay of Mr. Kartha, his travelling costs and certain incidental expenses.

Mr. Kartha is at present at Lucknow and I propose that he should at first proceed to Lahore and complete the work in the Northern Circle, probably visiting the Ferozepore Dairy from there. On the completion of this he would proceed to Karnal and then to Jubbulpore to bring the work already done in the Southern Circle up-to-date.

While so employed at the Military Dairies, I propose that Mr. Kartha should work under the guidance of the Assistant Controller of the Circle in which he is employed so as to get the maximum benefit from the records available.

On the completion of the compilations Mr. Kartha should proceed to Bangalore, where the figures could be criticised by the Imperial Dairy Expert and Mr. Warth and prepared for publication.

Mr. Kartha is available at present and willing to undertake the work provided that he can start soon. The rate of pay that I propose would be Rs. 200 a month, and I anticipate that travelling and contingent expenses would amount to a further Rs. 300 during the six months period.

A. OLVER, Colonel.

The 20th January 1932.

## APPENDIX XXV.

SUBJECT No. 2 (a).

## PROMOTION OF SCIENTIFIC RESEARCH IN THE EMPIRE.

## PROPOSAL FROM THE EMPIRE MARKETING BOARD.

Attention is invited to the attached letter (and enclosures) from the Empire Marketing Board, London, No. M.10517, dated the 4th March 1931 (Enclosure I) on the subject of future development of research in the empire on a co-operative basis and the reply thereto (Enclosure II) No. 1131|Agri, dated the 28th May 1931.

2. The Animal Husbandry and the Agricultural Experts to the Council have each drawn up in this connection a list of major problems for investigation in order of importance (Enclosures III and IV). Additions or amendments are particularly invited to these lists.

3. Three statements (Enclosures V—VII) showing (i) Statistics of the Area and Yield of certain important crops and quantities exported and the main countries to which they are exported; (ii) List of grants approved by the Empire Marketing Board (July 1926 to May 1931) and (iii) Research schemes so far sanctioned by the Imperial Council of Agricultural Research, are attached. The subject is now submitted for the consideration of the Advisory Board.

(Sd.) T. VIJAYARAGHAVACHARYA,

*Secretary.*

*The 31st December 1931.*

## ENCLOSURE I.

COPY OF LETTER FROM THE EMPIRE MARKETING BOARD, LONDON, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, INDIA, No. M.10517, DATED THE 4TH MARCH, 1931.

1. I am directed by Mr. Thomas, as Chairman of the Empire Marketing Board, to refer to certain aspects of the Board's work in the promotion of scientific research, which were considered at the recent Imperial Conference. Copies of two extracts (Annexures I and II) from the published proceedings of the Conference which bear upon the subject of this letter are annexed.

2. The limits within which the Board can contribute financially to new schemes are, of necessity, determined by the limits of the grant at their disposal, and present financial circumstances are such as to preclude any considerable expansion of the Board's activities in the field of research. They think it desirable none the less, in accordance with the recommendations embodied in the second of the enclosed extracts and the agreement reached in discussion between members of the Research Committee of the Imperial Conference and members of the Board's Research Grants Committee, to initiate an interchange of views in regard to the future development of research on a co-operative basis.

3. I am to enquire accordingly whether your Council would be so good as to supply the Board with a considered statement indicating what major problems they consider most urgently to demand, in the general economic interests of the

Empire, the application of further scientific research to their solution and on which of these problems they think that, in the present state of knowledge effort can most profitably be concentrated.

4. I am further to invite your Council to make any suggestions which they may desire to offer at this preliminary stage as to the methods by which each research thus indicated could most advantageously and economically be pursued, and as to the centre or centres within the Empire at which the necessary work would most appropriately be concentrated.

5. My Board are addressing this invitation to the authorities designated on the enclosed list (Annexure III). They propose, on receipt of replies, to circulate them, in such combined form as may prove most convenient, to the same authorities, and to make at that stage such proposals for their further discussion as the circumstances of the time may suggest.

(ANNEXURE I.)

EXTRACT FROM IMPERIAL CONFERENCE, 1930, SUMMARY OF PROCEEDINGS  
CMD.-3717, PAGE 52.

"The Conference commends especially that feature of the Board's policy which aims at the concentration and development in the most appropriate centres of scientific team work upon problems of interest to the Commonwealth as a whole, and notes as an example of special promise the recognition and extension of the Onderstepoort Veterinary Research Station as an Empire centre of research in the field of animal health."

(ANNEXURE II.)

EXTRACT FROM THE REPORT OF THE SUB-COMMITTEE ON THE EMPIRE MARKETING  
BOARD OF THE IMPERIAL CONFERENCE, 1930.

"As regards research, the Sub-Committee understand that in general the practice of the Board is to receive, and consider from time to time as they are received, applications for grants for the purpose of research. After hearing the views of the official representatives of overseas research organisations the Sub-Committee suggest that something more than this is needed if the fullest possible use of existing facilities for research on a co-operative basis is to be made. It should be a part of the Board's function not merely to receive applications for grants but to co-operate with existing research organisations for the purpose of planning joint programmes of research on a broad Empire basis. To this end periodical meetings of accredited representatives of research organisations and scientific specialists should be held, and periodical surveys of the results obtained in particular fields should be undertaken. The Sub-Committee are satisfied that in this way economies could be effected, and better results could be obtained for the same expenditure of money, through the concentration of research at the most suitable centres."

(ANNEXURE III.)

The Deputy Minister of Agriculture, Ottawa, Canada.

The President, National Research Council, 178, Queen's Street, Ottawa, Canada.

The Secretary, Commonwealth Council for Scientific and Industrial Research, 314, Albert Street, East Melbourne, Australia.

The Secretary, Department of Scientific and Industrial Research, Wellington, New Zealand.

The Secretary, Department of Agriculture, Pretoria, South Africa.

The Secretary, Department of Agriculture, Salisbury, Southern Rhodesia.

The Secretary, Department of Agriculture, Dublin, Irish Free State.

The Secretary, Imperial Council of Agricultural Research, New Delhi, India.

The Colonial Advisory Council of Agriculture and Animal Health, Colonial Office, Downing Street, S.W.-1.

(Letters in similar terms are being addressed to the appropriate scientific Institutes and Departments in the United Kingdom.)

#### ENCLOSURE II

COPY OF LETTER FROM M. S. A. HYDARI, Esq., I.C.S., SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, TO THE SECRETARY, EMPIRE MARKETING BOARD, LONDON, S.W.-1., No. 1131/AGRI, DATED THE 28TH MAY 1931.

#### Promotion of Scientific Research Work.

With reference to your letter (Enclosure I), No. M.10517, dated the 4th March 1931, I am directed to state that the question raised in paragraph 3 thereof will be referred to the January 1932 meeting of the Advisory Board of the Imperial Council of Agricultural Research. A reply to the Empire Marketing Board will be despatched as soon thereafter as possible.

#### ENCLOSURE III.

NOTE BY THE ANIMAL HUSBANDRY EXPERT, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

From the Animal Husbandry point of view the special problems of the greatest economical importance to India, which appear to me to demand urgent investigation in this country, and on which efforts could be most profitably concentrated by the Empire Marketing Board in the future development of research, on a co-operative basis, in order of urgency and importance, are :-

- (1) Tuberculosis and Johne's disease of cattle,
- (2) Contagious abortion and sterility,
- (3) The control and treatment of Entozoa parasites of all kinds of domesticated animals,
- (4) The special diseases of poultry,
- (5) Bacteriophage work in relation to the diseases of domesticated animals,
- (6) The correlation of such economic factors as
  - (a) Milk yield, and

(b) Disease resistance with observable characteristics in all kinds of domesticated animals,

(7) Foot-and-Mouth disease control.

In addition exhaustive enquiry and authoritative expressions of opinion are required regarding :—

- (a) the differentiation of various protozoal organisms such as various forms of Theileria and Piroplasma, Trypanosomes and Coccidia, and the appropriate measures for their treatment and control ;
- (b) the duration and efficacy of any protection which may be conferred on dogs by the numerous biological processes which have been advocated, from time to time, against Rabies, and what danger there may be from their use,
- (c) the clinical symptoms pathognomonic of mineral deficiencies, of various kinds, in the food of different classes of farm livestock,
- (d) the special diseases of equines, such as Strangles and the so-called influenza group, with particular reference to any effect they may have in producing, roaring and whistling.

The above list is not exhaustive of the many big problems of correlated, fundamental, research which urgently require solution and which can be satisfactorily dealt with only by co-ordination of work between investigators, engaged in dealing with the practical problems involved in the control of such conditions, and fundamental research workers, in a central institution, at which the results of such investigations can be collected and collated, and where the necessary funds for long-range research are available.

Besides these special problems the very big subject of Animal Nutrition has to be dealt with everywhere but, apart from a definition of the symptoms caused by deficiencies, such work must always be mainly a matter which can only be dealt with locally, in each country, in regard to the different varieties of food-stuffs produced, in different districts and under different conditions.

*Dated the 4th June 1931.*

#### ENCLOSURE IV.

NOTE BY THE AGRICULTURAL EXPERT, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

The Imperial Conference and the Empire Marketing Board contemplate nothing less than an Imperial programme of major problems urgently demanding scientific investigation in the general economic interests of the Empire. We are asked :—

- (i) to propose items for inclusion in that list ;
- (ii) to make preliminary suggestions regarding methods by which each research indicated could most advantageously and economically be pursued ; and
- (iii) to suggest the centre or centres in the Empire where such work could most appropriately be concentrated.

2. On the agricultural side the discussion is not so simple as in the case of animal problems, because more research work is in progress, in India and there is more scope for selection of problems. What the Empire Marketing Board clearly have in mind is the provision, in some part of the Empire, of special staff and equipment for the investigation of a particular problem for the benefit

of the Empire as a whole ; for some problems duplicate or subsidiary centres may be needed. It should be recognised at the outset that there are many problems which are not suited to this type of attack in force but that there are some problems in applied science which are admirably suited for this method. We are asked to suggest such problems and I give a list which, though far from exhaustive, may serve as a basis of discussion in the Advisory Board.

**3. Major Problems which urgently demand the Application of further scientific research in the General Economic interests of the Empire.**

(i) *Virus diseases of plants.*

Work of a high scientific order in the tropical and sub-tropical parts of the Empire is needed especially on the Mosaic disease of sugarcane and the virus diseases of potatoes.

(ii) *Rust on cereals.*

Very important work is in progress in Canada and India ; the Imperial Council of Agricultural Research is financing Dr. Mehta's fundamental work but extension of the latter is needed shortly.

(iii) *The water requirements of crops under irrigation conditions.*

(iv) *The important group of irrigation problems for which the Imperial Agricultural Conference, 1927, and the Royal Commission on Agriculture in India recommended an Empire irrigation research station.*

India possesses special advantages as a centre.

(v) *Agricultural Meteorology.*

India offers many advantages.

(vi) *The Genetics and Cytology of sugarcane.*

Work at two centres, *vis.*, in India and in a more typically tropical sugarcane country, *e.g.*, Trinidad, British West Indies, would seem necessary in the light of the discussions at the Empire Sugar Conference, 1931.

(vii) *The control of the Desert Locust.*

The maintenance of continuity in research, at whatever centres material may be forthcoming, is of great importance. So also is the maintenance and development of the intelligence system set up at the Imperial Institute of Entomology and financed in part by the Empire Marketing Board at present.

4. We also have to ask ourselves the following questions :—

(i) (a). What problems of Empire importance, if any, are being intensively investigated already in India ?

(b). Are there any problems for the study of which on an Empire basis India has special advantages ?

(ii) Can existing research institutes in India modify and expand their schemes of work so as to deal with Empire as distinct from purely Indian requirements if they receive substantial financial support ?

(iii) What problems, if any, are there where the principal investigation on a major problem has already been arranged for in Great Britain or in some part of the Empire other than India, but where subsidiary or confirmatory investigations of limited extent are needed in other environments. To what extent could

India co-operate in such subsidiary investigations, provided financial assistance were forthcoming.

It may make this point clear if I illustrate each question by an example.

- (i) Sugarcane breeding is an example of the first type of problem ;  
Rice genetics, cultivation and physiology of the second.
- (ii) The Coimbatore cane-breeding station, the Punjab irrigation research institute and the Botanical, mycological and entomological sections of the Pusa Research Institute are instances.
- (iii) An example of a problem where the purely scientific aspect at least is being investigated at other empire centres is found in the virus diseases of plants which at present are being investigated at 4 centres in the United Kingdom.

Extensions in India are required : facilities exist at Pusa, Cawnpore, Poona and probably elsewhere.

Another example is found in the economics of agricultural production. The principal investigation is being conducted by the Agricultural Economic Research Institute, Oxford, on an Empire basis but there is at present no adequate organisation to deal with the Indian aspect of the problem. The proposals now under investigation for ascertaining the costs of production of sugarcane, cotton and rotation crops will ensure a start on sound lines. Much would be gained by co-operation with Oxford.  
*The 30th December 1931.*

#### ENCLOSURE V.

##### STATEMENT A.

##### *Area and Yield of Rice in each Province.*

Province.	Area (acres).			Yield (tons).		
	1927-28.	1928-29.	1929-30.	1927-28.	1928-29.	1929-30.
Madras .. ..	10,930,000	11,019,000	11,262,000	5,083,000	5,197,000	5,159,000
Bombay (including Sind and Indian States).	3,539,000	3,551,000	3,363,000	1,517,000	1,641,000	1,321,000
Bengal .. ..	18,682,000	21,403,000	20,225,000	6,493,000	9,684,000	8,202,000
United Provinces ..	7,336,000	7,096,000	6,845,000	2,195,000	1,110,000	1,521,000
Burma .. ..	12,353,000	12,709,000	12,703,000	4,886,000	4,894,000	4,943,000
Bihar and Orissa ..	13,476,000	14,352,000	14,229,000	4,378,000	5,588,000	6,012,000
(d) Central Provinces and Berar (b).	6,054,000	6,199,000	5,827,000	1,753,000	1,647,000	1,885,000
Assam .. ..	4,173,000	4,963,000	4,230,000	1,308,000	1,677,000	1,389,000
Coorg .. ..	83,000	83,000	83,000	40,000	40,000	53,000
Hyderabad .. ..	933,000	992,000	507,000	345,000	403,000	151,000
Mysore .. ..	704,000	705,000	720,000	188,000	204,000	209,000
Baroda .. ..	207,000	201,000	192,000	48,000	60,000	33,000
Total .. ..	78,470,000	83,273,000	80,186,000	28,234,000	32,145,000	30,878,000

(b) Includes Indian States. (c) Including areas under seedlings which were subsequently transplanted. (d) Excluding Feudatory States, estimates for which for 1929-30 are 3,239,000 acres and 1,627,000 tons, as against 3,520,000 acres and 1,797,000 tons in 1928-29.

NOTE.—Figures for 1929-30 are subject to revision.



**STATEMENT A—contd.**  
**Area and Yield of Wheat in each Province.**

Province.	Area (acres)			Yield (tons).		
	1927-28.	1928-29.	1929-30.	1927-28.	1928-29.	1929-30.
Bombay (including Sind and Indian States).	2,380,000	2,503,000	2,469,000	596,000	499,000	546,000
Bengal .. .. .	107,000	123,000	126,000	22,000	32,000	33,000
United Provinces ..	7,588,000	7,218,000	7,298,000	2,394,000	2,500,000	3,342,000
(b).						
Punjab (b) .. .. .	10,304,000	11,299,000	11,321,000	2,764,000	3,423,000	4,208,000
Bihar and Orissa (a) ..	1,199,000	1,212,000	1,200,000	418,000	513,000	515,000
Central Provinces and Berar (b).	3,786,000	3,310,000	3,094,000	619,000	541,000	617,000
North-West Frontier Province (c).	993,000	1,056,000	1,057,000	161,000	231,000	248,000
Ajmer-Merwara .. ..	39,000	31,000	29,000	15,000	8,000	11,000
Delhi .. .. .	52,000	51,000	33,000	19,000	8,000	10,000
Hyderabad .. .. .	1,058,000	1,102,000	1,026,000	82,000	144,000	107,000
Mysore .. .. .	3,000	3,000	4,000	(g)	1,000	1,000
Baroda .. .. .	86,000	88,000	73,000	21,000	11,000	20,000
Gwalior .. .. .	1,458,000	1,021,000	943,000	165,000	193,000	178,000
Central India States ..	2,006,000	1,861,000	1,774,000	277,000	294,000	277,000
Rajputana States .. ..	1,134,000	1,095,000	901,000	238,000	193,000	240,000
<b>Total .. .. .</b>	<b>32,193,000</b>	<b>31,973,000</b>	<b>31,348,000</b>	<b>7,791,000</b>	<b>8,591,000</b>	<b>10,353,000</b>

(a) Excluding estimates for Orissa and Chota Nagpur Feudatory States which report an area of 2,400 acres with a yield of 300 tons in 1929-30, the same as in last year. (b) Includes Indian States.

(c). Includes the Tochi and the Kurram Agencies. (d). Includes Gwalior. (g). About 500 tons.

NOTE.—Figures for 1929-30 are subject to revision.

**Area and Yield Sugarcane in each Province.**

Province.	Area (acres).			Yield (tons) of raw sugar (gur).		
	1927-28.	1928-29.	1929-30.	1927-28.	1928-29.	1929-30.
Madras .. .. .	106,000	89,000	98,000	283,000	245,000	275,000
Bombay (including Sind and Indian States).	101,000	90,000	87,000	290,000	249,000	225,000
Bengal .. .. .	209,000	196,000	198,000	236,000	216,000	220,000
United Provinces (b)	1,599,000	1,357,000	1,356,000	1,534,000	1,220,000	1,346,000
Punjab .. .. .	499,000	401,000	307,000	381,000	289,000	210,000
Bihar and Orissa (c) ..	289,000	287,000	279,000	309,000	313,000	304,000
Central Provinces and Berar.	23,000	23,000	22,000	36,000	37,000	36,000
Assam .. .. .	41,000	39,000	30,000	42,000	40,000	29,000
North-West Frontier Province.	43,000	48,000	51,000	63,000	59,000	63,000
Delhi .. .. .	6,000	5,000	3,000	7,000	4,000	3,000
Hyderabad .. .. .	(a)	(a)	37,000	(a)	(a)	18,000
Mysore .. .. .	34,000	31,000	33,000	32,000	29,000	33,000
Baroda .. .. .	2,000	2,000	2,000	4,000	3,000	3,000
<b>Total .. .. .</b>	<b>2,952,000</b>	<b>2,568,000</b>	<b>2,503,000</b>	<b>3,217,000</b>	<b>2,704,000</b>	<b>2,765,000</b>

(a) Not available.

(b) Including Rampur State.

(c) Excluding Feudatory States, estimates for which for 1929-30 were 20,000 acres and 18,000 tons, against 22,000 acres and 21,000 tons in the preceding year.

NOTE.—Figures for 1929-30 are subject to revision.

**STATEMENT A—contd.**  
*Area and Yield of Tea in each Province.*

Province.	Area (acres).			Yield (lbs.)		
	1927.	1928.	1929.	1927.	1928.	1929.
Madras ..	58,100	63,600	66,900	24,132,200	26,785,400	27,633,600
Bengal .. ..	189,800	193,800	195,300	97,002,000	95,010,000	109,953,200
United Provinces ..	6,000	6,000	6,000	1,597,600	2,133,800	1,488,900
Punjab .. ..	9,700	9,700	9,700	2,076,400	1,904,900	1,930,100
Burma .. ..	(a)	(a)	(a)	(a)	(a)	(a)
Bihar and Orissa ..	1,900	3,800	4,100	306,600	719,600	853,200
Assam .. ..	424,000	427,200	429,600	235,887,800	246,017,700	255,940,700
Coorg .. ..	400	400	400	151,600	216,300	169,000
Mysore .. ..	1,900	2,400	3,200	(b)	81,700	30,900
Travancore	57,300	61,400	65,400	28,825,300	30,188,300	30,542,700
Cochin .. ..	..	..	300	..	..	290,400
Tripura (Bengal) ..	6,900	7,600	7,900	940,100	1,095,600	1,402,700
<b>Total ..</b>	<b>766,000</b>	<b>775,900</b>	<b>788,800</b>	<b>390,919,800</b>	<b>404,153,200</b>	<b>432,236,200</b>

(a) Discontinued.

(b) Not available.

Note.—Figures for 1929 are provisional and therefore subject to revision.

STATEMENT A—contd.  
Area and Yield of Cotton in each Province.

Province.	Area (acres).			Yield (bales of 400 lbs. each).		
	1927-28.	1928-29.	1929-30.	1927-28.	1928-29.	1929-30.
Madras (a) ..	2,123,000	2,495,000	2,507,000	447,000	528,000	513,000
Bombay (including Sind and Indian States). ..	7,763,000	8,046,000	7,150,000	1,801,000	1,446,000	1,309,000
Bengal (including Tripura State) ..	78,000	79,000	78,000	20,000	18,000	21,000
United Provinces (including Rampur State) .. ..	643,000	715,000	932,000	199,000	255,000	342,000
Punjab (f) ..	2,068,000	2,841,000	2,496,000	602,000	619,000	788,000
Burma .. ..	326,000	318,000	323,000	67,000	56,000	67,000
Bihar and Orissa (h)	77,000	78,000	69,000	14,000	14,000	13,000
Central Provinces and Berar .. ..	479,000	5,078,000	5,167,000	1,235,000	1,234,000	1,142,000
Assam .. ..	45,000	44,000	41,000	15,000	17,000	15,000
North-West Frontier Province ..	10,000	17,000	17,000	2,000	4,000	4,000
Ajmer-Merwara ..	42,000	44,000	34,000	14,000	21,000	11,000
Delhi .. ..	2,000	2,000	3,000	1,000	1,000	1,000
Hyderabad ..	3,631,000	4,019,000	3,536,000	951,000	895,000	447,000
Mysore .. ..	81,000	76,000	69,000	25,000	23,000	22,000
Baroda .. ..	806,000	793,000	771,000	124,000	69,000	127,000
Gwalior .. ..	585,000	645,000	633,000	115,000	107,000	89,000
Central India States	1,263,000	1,287,000	1,388,000	234,000	252,000	249,000
Rajputana States ..	422,000	476,000	507,000	97,000	123,000	104,000
<b>Total ..</b>	<b>24,761,000</b>	<b>27,053,000</b>	<b>25,721,000</b>	<b>5,963,000</b>	<b>5,782,000</b>	<b>5,264,000</b>
Net exports and Consumption (i) ..	..	..	..	5,861,000	6,674,000	..

(a) Includes the State of Banganapalle up to 1925-26 and also Pudukottai from 1926-27.

(f) Includes Indian State.

(h) Excluding Feudatory States, estimates for which for 1929-30 are 38,000 acres and 8,000 bales, as against 38,000 acres and 11,000 bales in 1928-29.

(g) Not yet available.

(i) The export as well as the consumption figures are for the year ending August. Prior to 1916-17 the estimates of mill consumption were based on returns of yarn produced by mills; subsequently the estimates framed by the Bombay Millowners' Association on the basis of returns furnished to them by mills were adopted. From 1923-24 mill consumption figures are being compiled by the Indian Central Cotton Committee on the basis of returns furnished under the Cotton Cess Act and these have been utilized. No reliable information is available regarding annual consumption outside the mills, but in 1911 a conventional estimate of 450,000 bales was adopted in consultation with the Bombay Cotton Trade Association (now East India Cotton Association). This estimate was revised to 1,000,000 bales in 1914-15 and to 750,000 bales in 1915-16.

NOTE.—Figures for 1929-30 are subject to revision.

STATEMENT A--*contd.*  
Area and Yield of Jute in each Province.

Province.	Area (acres).			Yield (bales of 400 lbs. each).		
	1928.	1929.	1930.	1928.	1929.	1930.
Bengal (a) ..	2,670,000	2,989,000	3,032,000	8,519,000	9,190,000	9,886,000
Bihar and Orissa ..	247,000	238,000	238,000	693,000	719,000	620,000
Assam .. ..	195,000	157,000	185,000	624,000	352,000	595,000
Cooch Behar ..	32,000	31,000	31,000	70,000	74,000	80,000
<b>Total (d) ..</b>	<b>3,144,000</b>	<b>3,415,000</b>	<b>3,486,000</b>	<b>9,906,000</b>	<b>10,335,000</b>	<b>11,81,000</b>
Exports and consumption (c) .. ..	..	..	..	11,431,000	11,436,000	(b)
Exports, mill purchases during the year and local (extra factory) consumption (c) ..	..	..	..	11,097,000	11,144,000	(b)

(a) Includes Tripura State from 1925.

(b) Not yet available.

(c) The exports as well as mill purchases and mill consumption are for the year ending June. The mill consumption, mill purchases and the extra-factory consumption (the latter being 500,000 bales for each year) are the trade estimates.

(d) Excluding Nepal for which no estimate of area or yield is available.

The figures of imports from Nepal are, however, stated below :—

	Bales.		Bales.		Bales.
1921 .. ..	75,000	1924 .. ..	70,000	1927 .. ..	82,000
1922 .. ..	57,000	1925 .. ..	41,000	1928 .. ..	72,000
1923 .. ..	58,000	1926 .. ..	40,000	1929 .. ..	64,000
				1930 .. ..	(b)

NOTE.—Figures for 1930 are subject to revision.

STATEMENT A—*contd.*  
Area and Yield of Linseed in each Province.

Province.	Area (acres).			Yield (tons).		
	1927-28.	1928-29.	1929-30.	1927-28.	1928-29.	1929-30.
Bombay (a) ..	108,000	125,000	115,000	13,000	16,000	10,000
Bengal .. ..	118,000	132,000	114,000	13,000	19,000	19,000
United Provinces (b)	423,000 <i>630,000</i>	210,000 <i>550,000</i>	218,000 <i>502,000</i>	55,000 <i>82,000</i>	29,000 <i>76,000</i>	44,000 <i>101,000</i>
Punjab .. ..	35,000	28,000	30,000	3,000	3,000	3,000
Bihar and Orissa ..	601,000	658,000	654,000	84,000	108,000	107,000
Central Provinces and Berar (a) ..	1,017,000	1,027,000	869,000	80,000	58,000	75,000
Hyderabad .. ..	318,000	269,000	242,000	11,000	11,000	12,000
Rajputana (Kotah) ..	60,000	110,000	57,000	7,000	2,000	3,000
Total (b) ..	2,681,000 <i>630,000</i>	2,559,000 <i>550,000</i>	2,299,000 <i>502,000</i>	266,000 <i>82,000</i>	246,000 <i>76,000</i>	273,000 <i>101,000</i>
GRAND TOTAL ..	3,311,000	3,109,000	2,801,000	3,48,000	322,000	374,000

(a) Includes Indian States.

(b) The figures in italics represent "mixed" crop, i.e., seed sown in the same fields with other crops. The estimates for the mixed crop of the United Provinces are highly conjectural; hence they have been kept separate.

NOTE.—Figures for 1929-30 are subject to revision.

## STATEMENT A—contd.

## Area and Yield of Rape and Mustard in each Province.

Province.	Area (acres).			Yield (tons).		
	1927-28.	1928-29.	1929-30.	1927-28.	1928-29.	1929-30.
Bombay (including Sind and Indian States).	172,000	223,000	313,000	22,000	16,000	39,000
Bengal .. ..	740,000	700,000	705,000	116,000	123,000	134,000
United Provinces (a)	171,000	339,000	207,000	18,000	42,000	42,000
	<i>2,580,000</i>	<i>2,670,000</i>	<i>2,341,000</i>	<i>278,000</i>	<i>308,000</i>	<i>479,000</i>
Punjab .. ..	951,000	1,722,000	1,061,000	150,000	162,000	152,000
Bihar and Orissa (b) ..	700,000	728,000	665,000	153,000	178,000	162,000
Assam .. ..	353,000	369,000	332,000	69,000	66,000	62,000
North-West Frontier Province.	121,000	111,000	141,000	9,000	10,000	10,000
Delhi .. ..	6,000	35,000	5,000	1,000	(200)	(400)
		(c)				
Hyderabad .. ..	11,000	14,000	11,000	(400)	(500)	(300)
Baroda .. ..	22,000	28,000	19,000	4,000	2,000	2,000
Rajputana (Alwar) .. ..	80,000	99,000	43,000	20,000	3,000	10,000
Total (a) .. ..	3,327,000	4,368,000	3,502,000	562,000	602,000	613,000
	<i>2,580,000</i>	<i>2,670,000</i>	<i>2,341,000</i>	<i>278,000</i>	<i>308,000</i>	<i>479,000</i>
Grand Total .. ..	5,907,000	7,038,000	5,843,000	840,000	910,000	1,092,000

(a) The figures in italics represent "mixed" crop, i.e., seed sown in the same fields with other crops. The estimates for the mixed crop of the United Provinces are highly conjectural; hence they have been kept separate.

(b) Excluding Feudatory States, estimates for which for 1929-30 are 84,000 acres and 7,000 tons, as against 81,000 acres and 6,000 tons in 1928-29.

(c) The sudden and abnormal increase is due to an exceptionally large area being put under the crop as the principal crops like wheat could not either be sown or were damaged where sown owing to want of rain.

NOTE.—Figures for 1929-30 are subject to revision.

## Area and Yield of Groundnut in each Province.

Province.	Area (acres).			Yield (tons) of nuts in shell.		
	1927-28.	1928-29.	1929-30.	1927-28.	1928-29.	1929-30.
Madras .. ..	3,337,000	3,679,000	3,209,000	1,671,000	1,830,000	1,522,000
Bombay (including Indian States).	1,064,000	1,423,000	1,211,000	860,000	1,140,000	718,000
Burma .. ..	540,000	599,000	585,000	145,000	160,000	190,000
Hyderabad .. ..	485,000	650,000	619,000	42,000	81,000	83,000
Total .. ..	5,426,000	6,351,000	5,624,000	2,718,000	3,211,000	2,513,000

NOTE.—Figures for 1929-30 are subject to revision.

STATEMENT A—*contd.*

*Summary of the latest forecasts for the whole of India for the seasons 1930-31. and 1929-30.*

Crop.	Estimated area, 1930-31.	Estimated outturn, 1930-31.	Final area, 1929-30.	Final outturn, 1929-30.
	Acres.	Tons.	Acres.	Tons.
Rice .. .. .	81,986,000	31,594,000	80,479,000	31,131,000
Wheat .. .. .	32,181,000	9,302,000	31,654,000	10,469,000
Sugarcane .. .. .	2,777,000	3,178,000 bales	2,515,000	2,761,000 bales
Cotton .. .. .	23,616,000	4,820,000	25,922,000	5,125,000
Jute .. .. .	3,492,000	11,255,000 tons		800,000 tons
Linseed .. .. .	3,020,000	378,000	2,802,000	380,000
Rape and Mustard .. .. .	6,513,000	977,000	5,907,000	1,095,000
Groundnut .. .. .	6,240,000	2,988,000	5,748,000	2,668,000
1931-32 Jute Acreage			1,858,000	5,560,000
			Outturn	(Bales)

## STATEMENT B.

*Quantities of exports of the principal crops and the main countries to which exported.*

*Rice (in lakhs of tons).*

	Years.		
	1928-29.	1929-30.	1930-31.
Total quantity exported .. .. .	18.2	23.2	22.8
To United Kingdom .. .. .	.4	.4	1.3
To Germany .. .. .	2.1	2.7	1.4
To Ceylon .. .. .	4.2	4.3	4.4
To Straits Settlements .. .. .	1.8	2.3	2.8
To Sumatra .. .. .	1.1	1.3	1.3
To Java .. .. .	.4	1.6	.5
To other countries .. .. .	8.2	10.6	11.1
<i>Wheat (in lakhs of tons).</i>			
Total quantity exported .. .. .	1.1	.1	2.0
To United Kingdom .. .. .	.8	.07	1.8
To other countries .. .. .	.3	.03	.2
<i>Sugar cane (in thousands of tons).</i>			
Total quantity exported .. .. .	2.1	1.3	1.0
To Ceylon .. .. .	1.6	1.1	.7
To other countries .. .. .	.5	.2	.3

STATEMENT B—*contd.**Raw cotton (in lakhs of tons).*

	Years.		
	1928-29.	1929-30.	1930-31.
<b>Total quantity exported .. .. .</b>	<b>6.6</b>	<b>7.3</b>	<b>7.0</b>
To United Kingdom .. .. .	.4	.5	.5
To Germany .. .. .	.6	.6	.6
To Belgium .. .. .	.6	.6	.4
To Italy .. .. .	.7	.7	.6
To Japan .. .. .	2.9	2.9	3.0
To other countries .. .. .	1.4	2.0	1.9
<i>Cotton (Twist and Yarn) (in millions of yards).</i>			
<b>Total quantity exported .. .. .</b>	<b>24.3</b>	<b>24.6</b>	<b>23.4</b>
To Iraq .. .. .	1.6	1.4	1.1
To Syria .. .. .	2.0	2.0	2.0
To Aden and Dependencies .. .. .	4.5	4.6	4.7
To Siam .. .. .	1.9	1.7	1.6
To China .. .. .	2.0	.8	.9
To Egypt .. .. .	4.2	4.6	4.0
To other countries .. .. .	8.1	9.5	9.1
<i>Cotton Piece goods (in million of yards).</i>			
<b>Total quantity exported .. .. .</b>	<b>149.2</b>	<b>133.4</b>	<b>97.7</b>
To Iraq .. .. .	18.7	13.0	8.9
To Aden and Dependencies .. .. .	5.5	4.0	3.2
To Arabia .. .. .	7.6	8.0	4.8
To Bahrein Islands .. .. .	5.4	4.2	2.4
To Persia .. .. .	23.8	18.9	13.4
To Ceylon .. .. .	17.8	18.8	17.7
To Straits Settlements (including Labuan) .. .. .	19.7	17.9	11.1
To Siam .. .. .	2.4	2.1	1.3
To Anglo-Egyptian Sudan .. .. .	3.7	2.8	2.2
To Portuguese East Africa .. .. .	7.7	7.9	6.6
To Tanganyika Territory .. .. .	12.5	11.1	10.1
To Kenya, Zanzibar and Pemba .. .. .	12.0	12.6	8.2
To other countries .. .. .	12.4	12.1	7.8
<i>Raw Jute (in lakhs of tons).</i>			
<b>Total quantity exported .. .. .</b>	<b>9.0</b>	<b>8.1</b>	<b>6.2</b>
To United Kingdom .. .. .	2.0	1.6	1.1
To Germany .. .. .	2.6	2.2	1.7
To France .. .. .	1.1	1.1	.9
To other countries .. .. .	3.3	3.2	2.5



STATEMENT B—*contd.**Jute Germany bags (in crores of numbers).*

	Years.		
	1928-29.	1929-30.	1930-31.
Total quantity exported .. .. .	49.8	52.2	43.4
To United Kingdom .. .. .	4.5	5.3	4.0
To Straits Settlements .. .. .	1.3	1.4	1.2
To Java .. .. .	4.2	3.7	4.2
To Siam .. .. .	1.2	1.1	.4
To Indo-China .. .. .	1.5	1.2	.5
To China .. .. .	2.5	4.3	2.0
To Egypt .. .. .	1.6	1.9	1.7
To Union of South Africa .. .. .	2.0	2.1	2.0
To Portuguese East Africa .. .. .	1.2	1.4	1.2
To United States of America .. .. .	2.0	1.7	1.1
To Cuba .. .. .	3.3	3.2	2.4
To Chile .. .. .	3.8	3.4	1.9
To Australia .. .. .	9.1	7.3	8.8
To Hawaii .. .. .	1.7	1.8	1.7
To other countries .. .. .	9.9	12.4	10.3
<i>Jute (Gunny Cloth) (in crores of yards).</i>			
Total quantity exported .. .. .	156.9	165.1	127.1
To United States of America .. .. .	102.2	107.2	85.3
To Argentine Republic .. .. .	34.0	33.0	20.9
To Canada .. .. .	7.6	8.2	7.3
To United Kingdom .. .. .	2.9	5.9	4.0
To other countries .. .. .	10.2	10.8	9.6
<i>Linseed (in thousands of tons).</i>			
Total quantity exported .. .. .	156.7	248.2	256.6
To United Kingdom .. .. .	18.1	79.5	57.6
To France .. .. .	47.0	50.7	25.0
To Italy .. .. .	27.8	28.4	32.7
To Japan .. .. .	19.7	10.2	2.8
To Australia .. .. .	21.6	22.8	11.0
To other countries .. .. .	22.5	56.6	127.5
<i>Rape (in thousands of tons).</i>			
Total quantity exported .. .. .	77.5	44.3	32.8
To United Kingdom .. .. .	28.7	7.8	10.6
To Germany .. .. .	9.5	6.3	2.3
To Netherlands .. .. .	11.9	15.5	3.8
To France .. .. .	11.0	9.8	10.6
To other countries .. .. .	16.4	4.9	5.5

STATEMENT B—*contd.**Groundnut* (in thousands of tons).

	Years.		
	1928-29.	1929-30.	1930-31.
Total quantity exported.. .. .	788.4	714.2	601.2
To United Kingdom .. .. .	48.0	53.2	47.2
To Germany .. .. .	241.2	210.1	119.8
To Netherlands .. .. .	132.5	154.2	167.4
To France .. .. .	216.2	210.9	172.2
To Italy .. .. .	121.3	64.7	77.0
To other countries .. .. .	29.2	31.1	17.6
	<i>Tea</i> (in thousands of lbs.)		
Total quantity exported.. .. .	30.9	29.8	64.5
To Iraq .. .. .	1.3	1.7	2.4
To Persia -- .. .. .	14.1	18.2	10.8
To other countries -- .. .. .	15.5	9.9	51.3
Total quantity of black tea exported -- --	26.7	27.2	13.6
Total quantity of green tea exported -- --	4.2	2.6	50.9

## ENCLOSURE VI.

Grants outstanding for research and other schemes approved by the Secretary of State on the advice of the Empire Marketing Board (July, 1926 to May 1931).

*Grants approved from June 1930 to May 1931, are italicised.*

Object of Grant.	Department or Body to whom Grant made.	Expenditure involved in Schemes approved by the Board.
<b>BIOLOGICAL AND AGRICULTURAL SCIENCES.</b>		
Development of Biological and Agricultural Departments of the University of Cambridge.	University of Cambridge . .	£10,000 p. a. for 5 years.
<b>FOOD PRESERVATION AND LOW TEMPERATURE RESEARCH.</b>		
Development of the work of the Low Temperature Research Station, Cambridge.	Department of Scientific and Industrial Research.	£35,500 capital; £3,000 p.a. for 5 years.
Erection of the Ditton Laboratory, East Malling, for cold storage experiments on a semi-commercial scale.	Department of Scientific and Industrial Research.	£55,000 capital; £25,000 spread over 5 years.
Research into the preservation and transport of fish at Torry Research Station, Aberdeen.	Department of Scientific and Industrial Research.	£33,300 spread over 3 years.
Survey of trade in frozen mutton and lamb from Abattoir in New Zealand to the wholesale market in London.	Department of Scientific and Industrial Research.	£1,250.
<i>Continuation during 1931-32 of food preservation and low temperature research at Cambridge, Ditton and Torry.</i>	<i>Department of Scientific and Industrial Research.</i>	<i>£37,266.</i>
<b>ANIMAL HUSBANDRY.</b>		
Research on the mineral content of natural pastures, with special reference to certain deficiencies in the soil and their effect on the growth and strength of livestock.	(a) Rowett Research Institute, Aberdeen.	£25,000 spread over 5 years.

Object of Grant.	Department or Body to whom Grant made.	Expenditure involved in Schemes Approved by the Board.
Research on the mineral content of natural pastures, with special reference to certain deficiencies in the soil and their effect on the growth and strength of livestock.	(b) Commonwealth Council for Scientific and Industrial Research.	£3,000 capital; £1,875 p. a. for 5 years.
Ditto.	(c) New Zealand Government.	£2,000 p. a. for 5 years.
Ditto.	(d) Government of Southern Rhodesia.	£2,500 capital; £2,500 p. a. for 3 years.
Stock-rearing problems in Palestine.	<i>Ad hoc</i> Committee ..	£4,900 spread over 3 years.
Erection of Silo at School of Agriculture, Cambridge, for trials of the economic value of silage made from grass.	School of Agriculture, Cambridge.	£200.
Grants-in-aid of work at Cambridge University on the physiology and growth of farm animals, etc.	University of Cambridge ..	£5,000 capital; £400 p. a. for 5 years; £500 guarantee.
<b>ANIMAL HEALTH.</b>		
Extension of the activities of the Onderstepoort Veterinary Research Station.	Government of the Union of South Africa.	£10,000 capital; £11,000 p.a. for 5 years.
<i>Research on Animal Health problems in Australia.</i>	<i>Commonwealth Council for Scientific and Industrial Research.</i>	£8,000 p. a. for 5 years.
Research into Metazoan Immunity.	Liverpool School of Tropical Medicine.	£3,000 p. a. for 3 years.
Investigation into use of B. C. G. vaccine in the protection of calves against tuberculosis.	Department of Animal Pathology, University of Cambridge.	£3,000 capital.
Provision of additional laboratory accommodation at the Department of Animal Pathology, University of Cambridge.	Department of Animal Pathology, University of Cambridge.	£4,250 capital.

Object of Grant.	Department or Body to whom Grant made.	Expenditure involved in Schemes Approved by the Board.
<b>WOOL.</b>		
Standardisation of wool quality.	Wool Industries Research Association.	£7,800 capital; £15,200 spread over 5 years.
Sheep breeding and biology of wool.	Animal Breeding Research Department, University of Edinburg.	£3,000 capital; £800 p. a. for 5 years.
Survey of Empire wools ..	Wool Industries Research Association.	£2,000 p. a. for 2 years; supplementary grant of £1,250.
Supply of wool packs for trials in Australia, New Zealand and South Africa.	Wool Industries Research Association.	£175; supplementary grant of £300.
<i>Imperial Wool Research Conference.</i>	....	£600.
<b>HIDES AND SKINS.</b>		
<i>Research on processing of New Zealand pelts.</i>	<i>New Zealand Department of Scientific and Industrial Research.</i>	£500 p. a. for 5 years.
<b>DAIRY RESEARCH.</b>		
Survey of literature on the condensing and drying of milk and milk residues.	Hannah Dairy Research Institute, Scotland.	£500, Supplementary grant of £250.
Study of faults in dairy products, including "Red Spot" in cheese and "fishiness" in butter.	National Institute for Research in Dairying, Reading.	£3,150 capital; £3,900 spread over 2 years; Supplementary grant of £2,500 for period up to 31st March 1931.
Production of Dairy Research Journal.	....	£1,000.
Feeding of milk to school-children in Scotland.	Department of Health for Scotland.	£5,000.
Research on cheese ripening	University of British Columbia.	£1,100 spread over 2 years; supplementary grant of £800 for third year.
<i>Investigation of tuberculous infection of milk.</i>	<i>Department of Health, Scotland.</i>	£1,400 p. a. for 2 years.
<i>Investigation into the problem of "openness" in cheese.</i>	<i>New-Zealand Dairy Research Institute.</i>	£500 capital; £2,000 p. a. for 4 years.
<i>Investigation into the technique of milk examination.</i>	<i>London School of Hygiene and Tropical Medicine.</i>	£600 p. a. for 2 years.
<b>POULTRY.</b>		
Research in poultry nutrition problems.	Rowett Research Institute, Aberdeen, and Hillsborough Experimental Station, Northern Ireland.	£7,300 capital; £2,440 p. a. for 5 years.
Research on the scientific feeding of poultry.	Animal Nutrition Institute, University of Cambridge.	£890 capital; £1,870 spread over 5 years.

Object of Grant.	Department or Body to whom Grant made.	Expenditure involved in Schemes approved by the Board.
Investigation into the production and marketing of table poultry, eggs, etc.	Harper Adams Agricultural College.	£5,000 capital; £8,492 spread over 5 years.
Study of quality in eggs and the effect of dietary factors on the hatching capacity of eggs.	Ontario Agricultural College, Guelph.	£350 Capital; £670 p. a. for 5 years.
<b>EXPORT OF PEDIGREE LIVESTOCK.</b>		
Towards cost of transport of pedigree livestock from the United Kingdom.	Government of Commonwealth of Australia.	£5,000 p. a. for 2 years.
Ditto.	<i>Government of British Columbia.</i>	£1,500.
Ditto.	Government of Kenya ..	£3,000 for first year, £1,500 p. a. for second and third years. <i>Balance from preceding years for fourth year.</i>
Ditto.	Government of Northern Rhodesia.	£600 for first year; £1,000 for second year.
Towards cost of transport of pedigree livestock from the United Kingdom.	Government of Southern Rhodesia.	£2,280 for first year, £2,000 for second year and £1,200 for third year.
Erection and maintenance of the London Quarantine Station.	Royal Agricultural Society of England.	£7,750 capital; £3,250 p. a. for 5 years.
<b>ENTOMOLOGY.</b>		
Establishment of a laboratory for breeding beneficial parasites.	Imperial Institute of Entomology.	£15,000 capital; £30,000 spread over 5 years.
Biological control of insect pests in the West Indies.	Ditto	£2,000 p. a. for 3 years.
Detert Locust Control ..	Ditto	£1,020; £2,720 for 1 year.
Research on the digestion of meat by the larvæ of flies and on the part played by micro-organisms in the nutrition of larvæ.	London School of Hygiene and Tropical Medicine.	£1,500 spread over 3 years.
Preliminary survey of problems of insect nutrition.	Hebrew University, Jerusalem.	£75 capital; £227 10s p. a. for 3 years.
Research into the infestation of stored products.	Imperial College of Science and Technology.	£10,775 capital; £15,936 spread over 5 years.
Towards cost of campaign against the warble fly.	Leathersellers' Company ..	£1,000.
Identification and accommodation of entomological specimens.	Natural History Museum, London.	£30,000 capital.

Object of Grant.	Department or Body to whom Grant made.	Expenditure involved in Schemes approved by the Board.
Establishment of an organisation to pursue entomological investigations in Australia.	Commonwealth Council for Scientific and Industrial Research.	£21,000 capital; £39,052 spread over 5 years.
Research into entomological control of noxious weeds.	Cawthron Institute, New Zealand.	£1,333 capital; £2,000 p. a. for 5 years.
Towards cost of tsetse fly research and experimental reclamation in Tanganyika Territory.	Government of Tanganyika Territory.	£2,000 p. a. for 5 years.
Control of pests and diseases of glass-house produce.	Cheshunt Experimental and Research Station.	£1,600 capital; £1,760 p. a. for 5 years.
<i>Investigation of entomological problems in Mauritius and Seychelles.</i>	<i>Government of Mauritius and Seychelles.</i>	£1,800 p. a. for 2 years.
<b>MICROLOGY AND PLANT PATHOLOGY.</b>		
Erection of new building to house the Imperial Mycological Institute.	Imperial Mycological Institute.	£8,000.
Investigation of the Problem of dry root disease in swedes and turnips.	Ministry of Agriculture and Fisheries.	£1,320 spread over 3 years.
Study of fungal wastage of fresh fruits exported from Palestine.	Zionist Organisation ..	£1,520 spread over 3 years.
Research into virus diseases of plants.	Rothamsted Experimental Station.	£1,835 capital; £12,800 spread over 5 years.
<i>Ditto</i> ..	Cheshunt Experimental and Research Station.	£1,040 capital; £6,350 spread over 5 years.
<i>Ditto</i> ..	Scottish Society for Research in Plant Breeding.	£4,450 capital; £8,000 spread over 5 years.
<i>Ditto</i> ..	University College, Dublin	£3,250 capital; £5,500 spread over 5 years.
Cotton disease research ..	Rothamsted Experimental Station.	£600 capital; £200 p. a. for 4 years.
<b>PLANT BREEDING.</b>		
Prosecution and co-ordination of research in grasses and clovers.	Welsh Plant Breeding Station, Aberystwyth.	£4,350 capital; £23,375 spread over 5 years.
Appointment of Plant Breeding Expert for study of Empire grass land problems.	Welsh Plant Breeding Station, Aberystwyth.	£3,650 spread over 2½ years.
Establishment of a Plant Breeding and Seed Research Station at New Zealand Agricultural College, Palmerston North.	New Zealand Department of Scientific and Industrial Research.	£2,500 capital; £2,500 p. a. for 5 years.

Object of Grant.	Department or Body to whom Grant made.	Expenditure involved in Schemes approved by the Board.
Experiments with plants of the tidal zone with special reference to <i>Spartina Townsendii</i> .	East Anglian Institute of Agriculture.	£220; supplementary grant of £1,000 spread over 3 years.
Research into production of strong strawed varieties of oats and barley.	University College, Dublin	£1,550 capital; £425 p. a. for 5 years.
Towards the maintenance of the Division of Plant Industry.	Commonwealth Council for Scientific and Industrial Research.	£4,000 capital; £6,000 p. a. for 2 years.
<b>HORTICULTURE.</b>		
Fruit research and standardisation of horticultural material.	East Malling Research Station, Kent.	£9,050 capital; £27,300 spread over 5 years.
Extension of facilities for research and provision of accommodation for Imperial Bureau of Fruit Production.	Ditto ..	£13,200 capital; £8,100 spread over 3 years.
Investigations into the keeping qualities of fruit and its relation to the nutrition of the tree and soil conditions.	Long Ashton Horticultural Research Station, Bristol.	£7,025 capital; £12,975 spread over 5 years.
Fruit Research investigations in New Zealand.	New Zealand Department of Scientific and Industrial Research.	£2,350 capital; £9,300 spread over 5 years.
Improvement of methods of packing, grading and shipment of citrus fruit.	Government of Palestine	£1,000 p. a. for 3 years.
Appointment of an Agricultural Officer to devote special attention to the development of a citrus industry.	Government of British Honduras.	£280, p. a. for 3 years.
Establishment of an experimental fruit farm with the object of testing the economic cost of growing and shipping bananas and grape fruit.	Government of Sierra Leone.	£1,500 capital; £1,500 p. a. for 5 years.
<b>ECONOMIC BOTANY.</b>		
Visits of Economic Botanists to Dominions and Colonies and employment of botanical collectors for work overseas.	Royal Botanic Gardens, Kew.	£20,000 spread over 5 years.
Classification of Herbarium specimens.	Ditto ..	£15,567 spread over 5 years.



Object of Grant.	Department or Body to whom Grant made.	Expenditure involved in Schemes Approved by the Board.
<p><b>DIETETICS.</b> Research into the vitamin content of fruits, vegetables and dairy products at the Lister Institute.</p> <p>Research into the physiological and pathological conditions associated with certain rationed and specialised diets, with special reference to Kenya native tribes.</p>	<p>Medical Research Council</p> <p>Rowett Research Institute, Aberdeen.</p>	<p>£24,000 spread over 5 years.</p> <p>£3,000 p.a. for 3 years.</p>
<p><b>COLONIAL AGRICULTURAL AND VETERINARY SERVICES.</b></p>	<p>Colonial Office ..</p>	<p>Approximate £6,000 up to 31st March 1931 and £7,000 p. a. for 5 years.</p>
<p><b>TROPICAL RESEARCH STATIONS.</b></p>	<p>Imperial College of Tropical Agriculture, Trinidad.</p> <p>East African Agricultural Research Station, Amani.</p>	<p>£21,000 capital ; £55,000 spread over 4 years. £16,000 for fifth year.</p> <p>£6,000 p. a. for 3 years, £6,000 p. a. for fourth and fifth years.</p>
<p>Towards cost of maintenance of Amani Station.</p>	<p>Imperial College of Tropical Agriculture, Trinidad.</p>	<p>£5,774 capital ; £3,806 p. a. for 5 years.</p>
<p><b>BANANA RESEARCH.</b> Prosecution of research into the production of a variety of banana immune from panama disease and investigation into transport of bananas under cold storage conditions.</p>	<p>Indian Tea Association ..</p>	<p>£3,125 capital ; £3,375 spread over 5 years.</p>
<p><b>TEA.</b> Towards the cost of establishment and development of a laboratory of plant physiology for the investigation of problems connected with the constitution and composition of the tea plant.</p>	<p>Tea Research Institute of Ceylon.</p>	<p>£1,000 capital.</p>
<p>Purchase of experimental small scale machinery and plant for the factory of the Tea Research Institute of Ceylon.</p>		

Object of Grant.	Department or Body to whom Grant made.	Expenditure involved in Schemes Approved by the Board.
<p style="text-align: center;"><b>RICE.</b></p> <p><i>Development of rice research in Burma and Bengal.</i></p>	<p><i>Indian Imperial Council of Agricultural Research.</i></p>	<p><i>£2,500 capital; £12,745 spread over 5 years.</i></p>
<p style="text-align: center;"><b>SUGAR.</b></p> <p>Development of sugar research in Mauritius.</p> <p><i>In aid of work of breeding of improved varieties of sugar-cane.</i></p> <p style="text-align: center;"><i>Ditto ..</i></p>	<p>Government of Mauritius</p> <p><i>Government of Barbados ..</i></p> <p><i>Government of British Guiana,</i></p>	<p>£2,000 p. a. for 5 years.</p> <p>£2,000 for 1 year.</p> <p>£1,000 for 1 year.</p>
<p style="text-align: center;"><b>TOBACCO.</b></p> <p><i>Towards cost of establishment of tobacco research station in Southern Rhodesia.</i></p>	<p><i>Government of Southern Rhodesia.</i></p>	<p><i>£3,000 spread over 2 years.</i></p>
<p style="text-align: center;"><b>TUNG OIL.</b></p> <p>Distribution of Tung Oil seeds for cultivation in various Empire countries and comparative study of the technical properties of Tung Oil from various sources.</p>	<p>Royal Botanic Gardens, Kew, and Research Association of British Print, Colour and Varnish Manufacturers.</p>	<p>£800, £750 p. a. for 5 years.</p>
<p style="text-align: center;"><b>COPRA.</b></p> <p>Research into the best methods of preparing copra of high quality for export.</p> <p>Improvement of methods of cultivation, handling, drying and grading of copra.</p>	<p>Government of the Federated Malay States.</p> <p>Government of Fiji ..</p>	<p>£1,150 p. a. for 4 years.</p> <p>£750 p. a. for 2 years.</p>
<p style="text-align: center;"><b>OIL PALM PLANTATION.</b></p> <p>Establishment of an experimental oil palm plantation.</p>	<p>Government of Sierra Leone</p>	<p>£1,500 p. a. for 2 years.</p>
<p style="text-align: center;"><b>LAC.</b></p> <p>Towards cost of maintaining marketing expert in England to supplement lac research being carried on in India.</p>	<p>Government of Bihar and Orissa.</p>	<p>£500 p. a. for 5 years.</p>

Object of Grant.	Department or Body to whom Grant made.	Expenditure involved in Schemes approved by the Board.
<b>SERICULTURE.</b>		
Towards the development of the silk industry in Jamaica.	Government of Jamaica ..	£1,900 spread over 3 years.
Towards the revival of the silk industry in Palestine.	Government of Palestine ..	£100.
<b>FLAX.</b>		
Development of research into problems of flax industry.	Linen Industries Research Association, Northern Ireland.	£2,250 capital; £16,500 spread over 5 years.
Flax development in Cyprus	Government of Cyprus ..	£2,500 spread over 3 years.
<b>INSECTICIDES.</b>		
Towards cost of collecting and investigating plants possessing insecticidal properties with a view to their commercial exploitation.	Government of British Guiana.	£200 p. a. for 5 years.
<b>FORESTRY AND FOREST PRODUCTS.</b>		
Maintenance of the Imperial Forestry Institute.	Imperial Forestry Institute, Oxford.	£4,750 p. a. for 2 years.
Extension of the functions of the Forest Products Research Laboratory, Princes Risborough, including work on the utilisation of Empire timbers.	Department of Scientific and Industrial Research.	£30,000 capital; £7,500 spread over 2 years; <i>supplementary grant of £7,000 for third year.</i>
<b>MECHANICAL TRANSPORT.</b>		
Experimentation and development of Mechanical Transport suitable for use in undeveloped parts of the Empire.	..	£60,000 spread over 5 years.
<b>FISHERIES.</b>		
Fisheries Research in Newfoundland.	Government of Newfoundland.	£5,000 capital; £5,000 p. a. for 5 years.
Cod Liver Oil research ..	..	£3,000.
<b>ECONOMIC INVESTIGATION.</b>		
Establishment of a Chair of Imperial Economic Relations at the London School of Economics.	University of London ..	£2,000 p. a. for 5 years.

Object of Grant.	Department or Body to whom Grant made.	Expenditure involved in Schemes approved by the Board.
Marketing of home agricultural products with special reference to the improvement of the existing methods of distribution and preparation for market.	Ministry of Agriculture and Fisheries.	£40,000 p. a. for 5 years; supplementary grant of £42,500 approved for 1931-2.
Investigations into problems of marketing organisation.	Ministry of Agriculture and Fisheries.	£12,000 p. a. for 3 years.
Marketing of Scottish Agricultural produce.	Department of Agriculture for Scotland.	£5,150 for 1929-30; £6,200 for 1930-31; £7,500 for 1931-32.
Organisation of Egg Marketing in Scotland.	Ditto ..	£1,000 p. a. for 5 years.
Improvement of Port and Bacon production in Scotland.	Ditto ..	£3,750 capital; £407 p. a. for 5 years.
Investigation into marketing of Northern Ireland Agricultural produce.	Ministry of Agriculture, Northern Ireland.	£900 p. a. for 3 years.
Investigation into the economies of small farms in Northern Ireland.	Government of Northern Ireland.	£600 p. a. for 3 years.
Collection and dissemination of data concerning the economics of Agricultural production within the Empire, with special reference to the technique and results of cost accounting and survey methods.	Agricultural Economics Research Institute, Oxford.	£700 p. a. for 5 years.
<b>CO-OPERATIVE MARKETING.</b>		
Fostering co-operative organisation of producers in the Empire and in aid of production of Year Book.	The Horace Plunkett Foundation.	£1,500 p. a. for 5 years.
<b>MISCELLANEOUS.</b>		
Research on fluctuations in the numbers of wild rodents.	Department of Zoology and Comparative Anatomy, University of Oxford.	£3,010 spread over 3 years.
Scheme of Economic Ornithology.	Departments of Zoology and Agriculture, University of Oxford.	£250 p. a. for 3 years.
Preliminary investigation into problems of the maturation of wine.	..	£1,250.
Comparative study of methods of soil analysis.	University College of North Wales, Bangor.	£430 for 1 year; supplementary grant for second year of £450.

## ENCLOSURE VII

## LIST OF SCHEMES SO FAR SANCTIONED BY THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH.

Scheme.	Total sanctioned Grant.	
<i>Madras Government.</i>		
	Rs.	A. P.
Grant for collating data on manurial experiments conducted in the past	1,650	0 0
Appointment of Veterinary Research officer .. .. .	50,000	0 0
Scheme for rice research .. .. .	1,15,660	0 0
<i>Bombay Government.</i>		
Grant for collating data on manurial experiments conducted in the past	3,129	0 0
Rice Physiology Scheme .. .. .	10,300	0 0
Scheme for sugarcane research in the Bombay-Deccan .. .. .	5,22,088	0 0
Appointment of Veterinary Research officer .. .. .	50,000	0 0
Investigation into the Virus diseases of plants in the Bombay Presidency	65,390	0 0
<i>Bengal Government.</i>		
Grant for collating data on manurial experiments conducted in the past	1,650	0 0
(Additional Grant Sanctioned) .. .. .	1,000	0 0
Bengal scheme of sugarcane crushing and gur-boiling .. .. .	5,703	0 0
Establishment of a sugarcane seedling testing station at Dacca .. .. .	13,050	0 0
Appointment of Veterinary Research officer .. .. .	50,000	0 0
Appointment of a Physical Assistant on the staff of the Agricultural Chemist, Bengal .. .. .	22,568	0 0
Appointment of a Physiological Chemist to study Animal Nutrition Problems at Dacca .. .. .	48,590	0 0
Scheme for rice research .. .. .	1,64,822	0 0
<i>United Provinces Government.</i>		
Lump sum grant to Shahjahanpur Research Station for a detailed examination of new seedling canes .. .. .	6,000	0 0
Lump sum grant for experiments in the designing of a satisfactory small power sugarcane crushing mill .. .. .	8,000	0 0
Grant to the Harcourt Butler Technological Institute, Cawnpore, for the provision of an experimental sugar plant .. .. .	2,25,000	0 0
Grant for collating data on manurial experiments conducted in the past	1,650	0 0
Appointment of Veterinary Research officer .. .. .	50,000	0 0
Breeding experiments by Dr. A. E. Slater in connection with the improvement of goats .. .. .	32,000	0 0
Scheme for rice research .. .. .	1,50,460	0 0

Scheme.	Total sanctioned Grant.
<i>Punjab Government.</i>	
	Rs. A. P.
Lump sum grant for experiments in the designing of a satisfactory small power sugarcane crushing mill .. .. .	8,000 0 0
Grant for collating data on manurial experiments conducted in the past	1,650 0 0
Appointment of Veterinary Research officer .. .. .	50,000 0 0
<i>Burma Government.</i>	
Grant for collating data on manurial experiments conducted in the past	1,650 0 0
Appointment of Veterinary Research officer .. .. .	50,000 0 0
Scheme for rice research .. .. .	2,41,736 0 0
<i>Bihar and Orissa Government.</i>	
Lump sum grant for experiments in the designing of a satisfactory small power sugarcane crushing mill .. .. .	8,000 0 0
Grant for water hyacinth scheme .. .. .	8,826 0 0
Scheme for the establishment of a sugarcane research station in Bihar and Orissa and for the appointment of a sugarcane specialist .. .. .	1,60,000 0 0
Grant for collating data on manurial experiments conducted in the past	1,650 0 0
Appointment of Veterinary Research officer .. .. .	50,000 0 0
Scheme for rice research .. .. .	2,02,140 0 0
<i>Central Provinces Government.</i>	
Grant for collating data on manurial experiments conducted in the past	1,650 0 0
Appointment of Veterinary Research officer .. .. .	50,000 0 0
Scheme for rice research .. .. .	1,08,800 0 0
<i>Assam Government.</i>	
Grant for collating data on manurial experiments conducted in the past	1,650 0 0
Appointment of Veterinary Research officer .. .. .	50,000 0 0
Scheme for rice research .. .. .	1,38,790 0 0
<i>North-West Frontier Province.</i>	
Appointment of Veterinary Research officer .. .. .	50,000 0 0
<i>Hyderabad State (Deccan).</i>	
Appointment of Veterinary Research officer .. .. .	50,000 0 0
<i>Imperial Institute of Agricultural Research, Pusa.</i>	
Scheme for the establishment of a sub-station of the Coimbatore Imperial Sugarcane Station at Karnal .. .. .	82,000 0 0
Scheme for research on "Mosaic" and other cane diseases at Pusa ..	1,46,890 0 0
Establishment of a Botanical Sub-Station at Karnal .. .. .	1,33,850 0 0
<i>Imperial Institute of Veterinary Research, Muktesar.</i>	
Appointment of a Proto-Zoologist .. .. .	} No cost worked out as yet.
Appointment of a Special Officer for investigation into Tuberculosis and Johne's disease among cattle. .. .. .	

*Director General of Observatories.*

Scheme.	Total sanctioned Grant.
Agricultural Meteorology .. .. .	2,05,000 0 0
<i>Punjab University.</i>	
Grant to Dr. A. N. Puri for research on the standardisation of Physico-Chemical single value measurements most suitable for Indian soils ..	5,250 0 0
Dr. Bhatnagar's scheme—Effect of Ions on plant growth .. ..	6,000 0 0
Investigation on the relation between Physico-Chemical properties and fertility of soils (by Dr. S. S. Bhatnagar) .. .. .	8,300 0 0
Investigation of the " Wither Tip " of Citrus Trees (Dr. Chaudhuri) ..	12,600 0 0
<i>Calcutta University.</i>	
Professor Mukherjee's scheme on research into properties of colloid soil constituents .. .. .	12,000 0 0
(Additional Grant sanctioned) .. .. .	1,500 0 0
Professor Mahalanobis' scheme for statistical investigation on experimental errors in field trials .. .. .	11,500 0 0
<i>Dacca University.</i>	
Grant for research on soil analysis, etc. .. .. .	30,724 0 0
<i>Research work directly under the control of the Imperial Council of Agricultural Research.</i>	
Grant to Dr. K. C. Mehta for investigation of rusts of wheat and barley ..	45,000 0 0
Grant to Dr. K. C. Mehta for investigation on Physiologic forms of wheat rusts .. .. .	3,000 0 0
Grant to Dr. K. C. Mehta for getting necessary relief from part of his duties at College .. .. .	3,500 0 0
Grant for the testing of drug Plasmoquine .. .. .	500 0 0
Grant for research on Locust (Lyallpur and Quetta) .. .. .	1,76,000 0 0
Sugar Technologist for three years .. .. .	65,700 0 0
Deputation abroad of the Sugar Technologist .. .. .	14,488 3 0
Hadi's process at Bhopal .. .. .	1,500 0 0
Hadi's process at Bilari .. .. .	10,600 0 0
Hemp Marketing officer (Total expenditure) .. .. .	14,578 6 6
Price for a bone-crusher, etc. ....	7,000 0 0

## APPENDIX XXVI.

SUBJECT No. 2 (b).

## PROPOSALS FROM THE EMPIRE MARKETING BOARD, LONDON, IN REGARD TO FURTHER RESEARCH IN INSECTICIDES AND FUNGICIDES.

Attention is invited to the attached letter (and enclosures) from the Empire Marketing Board, London, No. M|2419, dated the 19th May 1931 (Enclosure I), regarding further research in insecticides and fungicides. The point of reference is contained in the concluding sentence of paragraph 4 of the Board's letter.

The subject is now submitted for the consideration of the Advisory Board.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

*The 5th January, 1932.*

## ENCLOSURE I.

LETTER FROM THE EMPIRE MARKETING BOARD, LONDON, No. M|2419, DATED THE 19TH MAY 1931.

I am directed by the Chairman of the Empire Marketing Board to refer to the Board's letter [Enclosure I to Appendix XXV, Subject No. 2 (a)] No. M|10517 of the 4th March on the subject of an interchange of views in regard to the future development of research on a co-operative basis in accordance with the recommendations embodied in the resolutions of the last Imperial Conference.

2. At the time of the Imperial Conference the Board felt it desirable that advantage should be taken of the presence in London of overseas scientists to discuss with them the Board's work in the field of scientific research. Accordingly two meetings were held between representatives of overseas scientific organisations and members of the Board's Research Grants Committee. At those meetings it was agreed that a useful step in the promotion of co-operation could be effected if the Board were to arrange in future to inform, and where necessary, consult, overseas research organisations on particular applications submitted to the Board for grants for research. It was realised that this procedure would not be necessary in all cases, but would apply to those schemes which might have a general Empire significance.

3. One of the schemes of this nature which was discussed informally at the meetings with overseas scientists was that embodied in the Report (Annexure II) of the Insecticides and Fungicides Committee of the English Ministry of Agriculture. This Committee was appointed to report on the action required to carry into effect the resolution of the Imperial Agricultural Research Conference of 1927 in favour of further research in insecticides and fungicides, and their Report recommended an extension of work at five centres in this country with a view to a concerted attack upon the problems involved. The Ministry of Agriculture, in forwarding this Report to the Board suggested that the Board should decide whether they were prepared in principle to finance the scheme of investigations proposed by the Committee. If they were willing to do so the Ministry would approach the Institutes concerned with a view to the formulation of definite financial proposals.



4. I am accordingly to enclose herewith a copy of the papers dealing with the scheme which include semi-official letters from Dr. Rivett, Chief Executive Officer of the Commonwealth Council for Scientific and Industrial Research (Annexure IV), Dr. du Toit, Director of Veterinary Services, Union of South Africa (Annexure V) and Dr. Clouston, late Agricultural Adviser to the Government of India (Annexure VI) together with a note (Annexure VII) of the discussions which took place with Dr. Fryer of the Ministry's Plant Pathological Laboratory. I am to ask that the Board may be furnished with your Council's observations in due course with particular reference to the interest and possible application of the scheme to problems in India and also with any suggestions you may have for linking up the proposed research with work already undertaken or in progress there.

#### ANNEXURE I.

LETTER FROM THE MINISTRY OF AGRICULTURE AND FISHERIES, LONDON, TO THE SECRETARY, EMPIRE MARKETING BOARD, No. T. G.-8443, DATED THE 14TH MARCH 1930.

It will be within the recollection of your Board that the Imperial Agricultural Research Conference, 1927, passed a resolution in the following terms regarding the need for further research in insecticides and fungicides :—

“ That, in view of the great importance of insecticides and fungicides in the control of diseases and pests, and, in view of the very limited number of substances now available for this purpose, and of their relative inefficiency, this Joint Meeting of members of the Entomology, Plant Pathology and Fruit Committees recommends that an investigation of the whole chemical field should be undertaken by chemists working in collaboration with entomologists and plant pathologists.

For such an investigation, new appointments would be necessary, since existing workers are already fully occupied ”.

2. Following the issue of the report of the Conference, the Ministry gave careful consideration to the various questions raised by this resolution, particularly so far as this country is concerned, and, with the concurrence and assistance of your Board, a Committee was set up to report on the action required to carry the resolution into effect.

3. The Committee was composed as follows :—

Mr. J. C. F. Fryer, O.B.E., M.A. (*Chairman*).  
 Professor V. H. Blackman, M.A., Sc.D., F.R.S.  
 Dr. E. J. Butler, C.I.E., D.Sc., F.R.S.  
 Dr. J. T. Hewitt, M.A., D.Sc., Ph.D., F.R.S.  
 Dr. G. A. K. Marshall, C.M.G., D.Sc., F.R.S.  
 Dr. G. H. Pethybridge, M.A., B.Sc., Ph. D.  
 Professor J. C. Philip, O.B.E., D.Sc., F.R.S.

The Research Grants Committee of your Board agreed at the time of the formation of the Committee to consider favourably applications submitted on its recommendation, and to refer to it applications concerning research in insecticides and fungicides.

4. The report (Annexure II) of the Committee has now been presented and a copy is forwarded herewith for the consideration of your Board.

5. The case for an extension of work in insecticides and fungicides is fully presented in the Committee's report, and on the general question of the desirability of a concerted attack upon the problems involved there is no need for comment by the Ministry. It will be observed that the Committee presents estimates for expenditure over a period of 10 years. The Ministry presumes, however, that any grants sanctioned by your Board would in the first instance, be for a period not exceeding five years. A programme for a period of less than five years would scarcely be worth while if the attack on the problems involved is to be seriously pursued; and although any arrangements during this period would necessarily be temporary and subject to revision, it is practically certain that continued attention will need to be given to this very complex and difficult subject, and that in some form or other a research organisation will need to be maintained for an indefinite period. On the basis adopted by the Committee a maintenance expenditure of £7,816 in the first year would be required rising to £8,828 in the fifth year, with an additional expenditure for capital purposes of £4,000. The total expenditure in the five years would be some £46,000. Compared with the expenditure in all parts of the Empire on insecticides and fungicides this sum, although considerable, is relatively insignificant.

6. The Committee's proposals may be summarised as follows:—

(a) A Central Team to be placed at the East Malling Research Station, the maintenance expenditure excluding capital expenditure being roughly £20,000 over a period of five years. In addition, capital expenditure estimated at £4,000 would be required. This is the only centre at which capital expenditure is contemplated, the main part being for the purchase of additional land, some of which should be fruit bearing. Buildings and equipment are not likely to be a costly item, since all that is in view is some small alteration of existing laboratories and the provision of an insectary, laboratory and greenhouse.

The whole scheme of the Committee rests upon the central team at the East Malling Research Station. The Ministry felt some hesitation in adopting this standpoint, having particular regard to the rapid growth of the East Malling Station and the possible difficulties that might arise if too great a burden were placed upon the shoulders of the Director and his staff. This matter has been discussed with the Committee, which, having weighed the advantages and disadvantages, still adheres to the view that East Malling is the best situation for the central team. In this view the Ministry acquiesces.

(b) At Cambridge it is proposed to appoint an additional chemist on the staff of the Horticultural Research Station, at a total cost of about £2,700 in five years.

(c) At the Rothamsted Experimental Station additional staff is proposed costing approximately £8,400 in five years.

(d) At the Long Ashton Research Station additional staff is proposed costing approximately £6,300 in five years.

(e) At the South Eastern Agricultural College, Wye, an appointment of a Grade II assistant to Dr. Goodwin is proposed at a cost

amounting to approximately £3,600 in five years. The Ministry feels that there is some objection from the administrative standpoint to developing an advisory centre as a small research institute, for the reasons that the adviser is deflected from his proper duties and further that no continuity of research can be guaranteed. The Ministry has discussed with the Committee the question whether Dr. Goodwin might be given the opportunity of transferring to an appropriate research institute ; but, after further consideration, the Committee has recommended that the assistant chemist proposed for him should be added to the central team appointments, and that the holder of the post should be seconded to work at Wye under his personal direction.

- (f) It should be remarked that the proposals of the Committee have not been communicated to the authorities at Cambridge, Rothamsted, Long Ashton or Wye ; and it cannot, therefore, be assumed that these bodies concur in the detailed arrangement proposed, although it is known that they are generally favourable to participating in the scheme. It is expected that the staff required at each of these stations could with little difficulty be housed in the existing accommodation, and no provision has, therefore, been made for capital expenditure.

7. There is a further matter of importance to which the Ministry desires to refer. At the present time little is known of the principles underlying the mechanical application of insecticides and fungicides ; and the appliances available to the grower are relatively ineffective. There is a danger, therefore, lest the benefit of advances on the chemical and biological sides may be largely lost because of the inability of the users to apply new insecticides or fungicides effectively on a commercial scale.

The Committee felt that its terms of reference precluded its reporting on this aspect ; but after discussion with the Ministry, it has placed on record its opinion that research on spraying machinery and the practical problems involved in the application of spray fluids and dusts is urgently needed, and has intimated that the initiation of a suitable scheme for the investigation of the subject both from the mechanical (engineering) and physical points of view would have its cordial approval. The Ministry has ascertained that it would be possible to arrange for an investigation into the problems involved and that, if funds were provided, the Long Ashton Research Station and the Institute for Agricultural Engineering at Oxford would be prepared to co-operate with the Ministry's Pathological Laboratory in a joint scheme. The Ministry would gladly take steps to obtain a detailed scheme with estimates of cost if your Board agreed in principle that such an investigation should be undertaken.

8. Your Board will observe that the whole of the work envisaged by the Committee is proposed to be undertaken in this country, with the exception of practical experiments on insecticides and fungicides overseas. This is in accordance with the views of the Joint Committee which formulated the proposal adopted by the Imperial Agricultural Research Conference, based principally on the great recent development in chemical science in Great Britain and the need in any fresh attack on the problems for close association of biologists and chemists in touch with the latest developments in chemical industry.

9. The Ministry would suggest that your Board might, in the first instance, decide whether it is prepared in principle to finance the scheme of investigations proposed by the Committee and the further investigations suggested into

the mechanical application of spray fluids and dusts. The Ministry would then propose to communicate with the institutions which it is suggested should take part in the investigations in order that definite financial proposals may be made.

## ANNEXURE II.

### REPORT OF THE INSECTICIDES AND FUNGICIDES COMMITTEE.

To

THE MINISTER OF AGRICULTURE AND FISHERIES.

SIR,

At a joint meeting of the Committees on Entomology, Plant Pathology, and Fruit of the Imperial Agricultural Research Conference, 1927, when the subject of insecticides and fungicides was considered, the following resolution was adopted :—

“ That, in view of the great importance of insecticides and fungicides in the control of diseases and pests, and in view of the very limited number of substances now available for this purpose, and of their relative inefficiency, this Joint Meeting of members of the Entomology, Plant Pathology and Fruit Committees recommends that an investigation of the whole chemical field should be undertaken by chemists working in collaboration with entomologists and plant Pathologists.

For such an investigation, new appointments would be necessary, since existing workers are already fully occupied.”

With a view to giving effect to this recommendation, the present Committee, the members being—

Mr. J. C. F. Fryer, O.B.E., M.A. (*Chairman*),

Professor V. H. Blackman, M.A., Sc.D., F.R.S.,

Dr. E. J. Butler, C.I.E., D.Sc., F.R.S.,

Dr. J. T. Hewitt, M.A., D.Sc., Ph.D., F.R.S.,

Dr. G. A. K. Marshall, C.M.G., D.Sc., F.R.S.,

Dr. G. H. Pethybridge, M.A., B.Sc., Ph.D.,

Professor J. C. Philip, O.B.E., D.Sc., F.R.S.,

Mr. J. H. Steward,

Mr. C. T. Gimingham, O.B.E., B.Sc.,

} *Joint Secretaries,*

was appointed in November, 1928, with the following terms of reference :—

“ To report as to the action required to carry into effect the recommendation of the Imperial Agricultural Research Conference that investigations should be made of the whole chemical field of insecticides and fungicides by chemists working in collaboration with entomologists and plant pathologists.”

1. It is an undisputed fact that immense losses are annually incurred throughout the world by the depredations of pests and by diseases of cultivated crops. A proportion of such losses may be obviated by mechanical, cultural and biological methods of control, but there is not the least doubt that, at all events for many years to come, measures involving the use of chemicals to destroy insect pests and parasitic fungi and bacteria, or to prevent their attacks, must remain the most important line of defence. Unfortunately, no statistics are available of the total consumption of insecticides and fungicides within the Empire which would demonstrate the outstanding importance of the subject. Some idea may, however, be gained from other considerations. There are, for instance, at least 4,000,000 acres of fruit within the Empire: if only one-quarter of this—i.e., 1,000,000 acres—be sprayed only twice a year (and this is a very low estimate), not less than 1,000,000,000 gallons of spray-fluids will be used. Taking the average cost of the spray-fluids as 1d. per gallon of dilute wash, the expenditure on chemicals for spraying fruit is not less than £4,000,000 a year, apart from the labour in applying them, and if labour costs are included, can hardly be less than £10,000,000. Again, a large proportion of the wheat sown is, or should be, chemically treated before sowing, while most of the potatoes produced within the Empire are grown successfully only by means of spraying with chemicals. It is, indeed, no exaggeration to say that, under modern conditions, few crops of any importance can successfully be grown without the intervention of insecticides or fungicides in some form, and in view of the immense issues at stake it is rather remarkable that up to the present so small an effort has been made to discover substances having valuable insecticidal and fungicidal properties, and to find how these properties can be turned to useful account. These considerations are by no means new, and the need for such work has indeed been strongly emphasised at meetings of entomologists and mycologists from overseas convened by the Imperial Bureau of Entomology and Mycology.

2. A relatively small number of substances form the basis of the great majority of insecticides and fungicides at present in commercial use in agriculture and horticulture. Excluding substances which have been employed only occasionally, for special purposes, or only in experimental work, the following list covers all the more important materials used in practice:—

*Insecticides*.—Certain arsenic and fluorine compounds. Soaps, mineral oils, lime-sulphur, nicotine, quassia, pyrethrum, derris (tubaroot), hellebore; certain tar-distillate fractions.

Hydrocyanic acid, calcium cyanide, sulphur dioxide, carbon disulphide, tetrachlorethane, crude cresylic acid, p-dichlorobenzene.

*Fungicides*.—Certain copper and sulphur compounds. Formaldehyde, certain mercury and arsenic compounds.

Even this short list includes several materials which have only a limited use.

3. The application of the substances mentioned above as insecticides or fungicides has, in many cases, been discovered accidentally or by purely empirical methods, and we are still mainly dependent for the protection of our crops against insect and fungus pests on the same few basic materials as were in use many years ago. Important advances have been made in some directions but without detracting from valuable work already carried out and in progress,

it is clear that there is great need to supplement sporadic and empirical investigations with a wide and systematic survey of the chemical field for possible new insecticides and fungicides. The fact that a great proportion of the insecticidal and fungicidal preparations sold are in the form of proprietary articles of undeclared composition and sometimes of doubtful value, is an additional argument in favour of extending research work on the subject, since such work may be expected to lead eventually to an increase in the number of "standard" products of specified composition and of real efficiency.

4. Moreover, our knowledge of the materials already in use is, in certain respects, still scanty and unsystematised. Very little is known of the mode of action of insecticides and fungicides, though such fundamental information is of the greatest importance. Many problems are still unsolved with regard to the chemistry of known insecticides and fungicides, with regard to their physical properties, and to the effect of differing conditions on their efficiency as killing agents or preventives, and on their effect on the host plant. More systematic and comprehensive researches in these and other directions are needed. It is not that the investigators already engaged on these subjects are failing to turn out good work, but that their numbers are too few and the available facilities inadequate for rapid progress. The position is perhaps partly explained by the fact that the field has very largely been left to entomologists and mycologists, who usually have little or no time for fundamental work on insecticides and fungicides, and who, in many cases, have insufficient training in chemistry for such work.

5. For spraying purposes, a good insecticidal or fungicidal preparation must not only be highly toxic to the organisms against which it is to be used, but must be easily miscible (*i.e.*, have a high power of remaining suspended in a fluid medium or be readily emulsifiable), must possess good powers of spreading and wetting, and in many cases be sufficiently adhesive to remain on foliage even in wet weather. Preparations to be used as dusts must be in an extremely fine state of division, have a suitable apparent density, and possess the least possible tendency to form larger aggregates on distribution. In addition, insecticides and fungicides must cause no damage, or relatively very slight damage, to the crops to which they are applied; and it is a further great advantage if they are harmless or only slightly poisonous to domestic animals and man.

In view of these requirements it will be evident that, in investigations such as the Imperial Agricultural Research Conference has recommended, a great variety of problems will arise, involving chemical, physico-chemical, entomological, mycological, and physiological questions, which will need the close co-operation of chemists and biologists for their solution. The Committee's task, therefore, has been to draft a workable scheme for such co-operative research.

6. Valuable work on various problems in connexion with insecticides and fungicides is already in progress in this country at several research stations: and important advances have been made by workers at the Rothamsted Experimental Station, at the Agricultural and Horticultural Research Station of the University of Bristol, Long Ashton, at the Horticultural Research Station, University of Cambridge, at the Research Station, East Malling, Kent, and at the South-Eastern Agricultural College, Wye, Kent. The Committee considers that these workers have a strong claim for further support and assistance on account of the results that have already been achieved, and their special training and fitness for the particular lines of work undertaken and proposed. Some (indeed

most) of these men have other duties to perform in addition to carry on research work on insecticides and fungicides, and in all cases progress is delayed by the lack of sufficient trained assistants.

7. In spite, however, of the good work already accomplished and in progress, the number of existing workers is far too few to cover the whole field and large gaps remain to be filled. At an early stage of the discussions, the committee reached the conclusion that the first and essential requirement was an organisation consisting of a team of workers, situated at one centre and including both chemists and biologists, which should explore the chemical field, with the direct object of searching for new materials that might be employed as insecticides and fungicides, of investigating the possibilities of their employment in practice, and of comparing them with those already known. Such a central team should be so composed as to be able to undertake entomological, mycological, and physiological investigations; and the necessary laboratories should be situated at one of the existing agricultural or horticultural institutions, where experimental field work both on small plots and on a larger scale could be carried out. In investigations of this nature, it is most important that the Laboratory workers should readily be able to keep in touch with practical operations, and, equally, that the men concerned with the field work should not lose sight of the scientific aspects of the problem. If possible, also, the location should be such that both fruit and other crops are available for field experiments. It should also be within easy access of London in order to avoid any risk of isolation, to facilitate visits to libraries and attendance at meetings, and to render it easy for visitors from overseas to see the work in progress.

If a central team be set to work on these lines, the researches already in progress, which it is proposed shall be extended, fall naturally into place as complementary to the work to be undertaken by the team.

8. The question of the most suitable centre at which the suggested team could work has been the subject of full and careful consideration; the proposals submitted to the Ministry of Agriculture by five institutions have been carefully examined, and the Committee has visited three of them. The conclusion has been reached that the particular conditions required for work of this kind could be most satisfactorily provided at the Research Station at East Malling, Kent.

#### *Recommendations.*

9. The detailed recommendations which follow, based on the foregoing observations, form a scheme which, if suitable personnel can be found, may be expected "to carry into effect the recommendation of the Imperial Agricultural Research Conference".

It has been ascertained that the East Malling Research Station would welcome the proposals made in Recommendation A.

Although the Committee has no definite information, it is believed that the Directors of the other stations concerned would assent to the suggestions made in Recommendations B, C, D, and E, for extending the work at their respective stations, although these suggestions, in many respects, fall considerably short of the proposals submitted.

A. The Committee recommends the formation of a team of research workers charged with the duties outlined in Section 7, to work at the Research Station at

East Malling, Kent. It is proposed that the team should be constituted as follows:—

	Cost per annum.		
	1st year.	5th year.	10th year.
	£	£	£
1 Chemist in charge (Grade I) .. ..	630	730	830
1 Assistant Chemist (Grade II) .. ..	425	505	605
1 " " (Grade III) .. ..	320	380	380
1 Mycologist (Gr. III rising to II) .. ..	320	400	500
1 Entomologist (Gr. III rising to II) .. ..	320	400	500
1 Plant Physiologist (Grade III rising to II)..	320	400	500
	2,335	2,815	3,315
Superannuation .. ..	234	282	332
	2,569	3,097	3,647
Maintenance (including wages of 3 laboratory attendants, 1 gardener and 1 laboratory boy)	1,300	1,300	1,300
<b>Total cost per annum</b>	<b>3,869</b>	<b>4,397</b>	<b>4,947</b>

The Committee has ascertained that most of the laboratory accommodation required by such a team is, or will shortly be, available at the East Malling Research Station, though slight structural alterations to the existing laboratories may be needed. It would, however, be necessary to provide an insectary, insectary laboratory, and a suitable greenhouse divided into three or four sections. Further, as the present plantations at East Malling are already fully utilised for experimental purposes, the purchase of a new area of land—say 10 acres—near the Research Station, to be available specially for spraying experiments, would be essential; and it is suggested that at any rate part of this new area should consist of land already carrying established fruit trees.

The Committee estimates that a sum of approximately £2,500 would be required to purchase the necessary land and that a further sum of £1,500 would cover the cost of erection of an insectary, insectary laboratory and greenhouse, and some slight alterations to the present laboratories; the total capital expenditure thus being approximately £4,000.

B. Physico-chemical problems in connection with spray-fluids have an important bearing on the work to be undertaken by the proposed central team. Questions in regard to the wetting, spreading, and adhesive properties of spray-fluids, the suspension of fine particles in a liquid medium, and problems of emulsification must necessarily arise. The Committee is impressed by the work already carried out by Mr. R. M. Woodman at the Horticultural Research Station, University of Cambridge, on problems of this kind, and realises that lack of any assistance is definitely delaying progress. Arrangements should be made for co-operation between Mr. Woodman and members of the



team, and the Committee recommends that an assistant chemist and a laboratory attendant should be appointed at the Horticultural Research Station, Cambridge, to enable Mr. Woodman to extend his work on the lines indicated.

The cost would be :—

	1st year.	5th year.	10th year.
	£	£	£
1 Assistant Chemist (Grade III) .. .. .	320	380	380
Superannuation .. .. .	32	38	38
	<hr/>	<hr/>	<hr/>
	352	418	418
Maintenance (including wages of laboratory attendant) .. .. .	150	150	150
	<hr/>	<hr/>	<hr/>
Total cost per annum .. .. .	502	568	568
	<hr/>	<hr/>	<hr/>

C. Certain fundamental chemical and bio-chemical aspects of the study of insecticides and fungicides on which there is available at present only the very scantiest information do not fall within the scope of the work which it is proposed that the central team shall undertake. For example, little or nothing is known as to the mode of action of many insecticides, a lack of knowledge which partly accounts for the empirical nature of much of the work so far accomplished. A series of valuable pioneering researches on contact insecticides has been carried out at the Rothamsted Experimental Station, and the Committee is of opinion that work of the kind indicated could most suitably be done at that station. It is complementary to that assigned to the central team, and the workers at the East Malling and Rothamsted Stations should be in close touch with one another.

The following staff would enable this to be undertaken in an adequate manner :—

Head Chemist (Grade I).

Assistant Chemist (Grade II).

Entomological physiologist or bio-chemist (Grade III, rising to II), with maintenance, including wages of laboratory attendants.

The Committee understands that the existing staff at Rothamsted, available for work on insecticides and fungicides consists of a Grade II Chemist

(Dr. F. Tattersfield) with a grant of approximately £450 per annum for assistance and maintenance, the funds (£1,000 per annum) being provided by the Ministry.

	1st year.	5th year.	10th year.
	£	£	£
Head Chemist (Grade I) .. .. .	655	755	830
Entomological physiologist or bio-chemist (Grade III, rising to II) .. .. .	320	400	500
	<hr/>	<hr/>	<hr/>
	975	1,155	1,330
Superannuation .. .. .	98	116	133
	<hr/>	<hr/>	<hr/>
	1,073	1,271	1,463
Additional maintenance (including wages of labora- tory attendants).	500	500	500
	<hr/>	<hr/>	<hr/>
	1,573	1,771	1,963
	<hr/>	<hr/>	<hr/>

(The Committee desires to point out that Dr. F. Tattersfield has been responsible for much work of great value in the field of insecticides, and is one of the pioneers in research of this type. The above recommendations are made on the assumption that he would be promoted to the new Grade I appointment, unless he has previously taken some other post under the scheme. A post for a Grade II chemist would thus be set free at Rothamsted, and it is further assumed that it would be filled by the appointment of an assistant chemist in Dr. Tattersfield's department.)

D. Certain important lines of work, collateral to those already indicated could best be undertaken at the Long Ashton Research Station and at the South Eastern Agricultural College, Wye, since workers specially fitted for such investigations are on the staffs of these institutions.

At Long Ashton, Professor Barker and his colleagues have for some time past been investigating the fungicidal action of sulphur and results of much interest and importance are emerging. Owing, however, to lack of assistance (the chemists on the staff being already fully engaged on other work) progress has been slow. Secondly, the study of insecticidal and fungicidal dusts, more particularly in regard to the practical problems concerned with their application, was included in the proposals put forward by the Long Ashton Station, and assistance is urgently needed for this work also. The use of dusts other than sulphur is a comparatively recent development and there are many points on which research is much needed.

The Committee, therefore, recommends that one chemist and one physicist, with an appropriate maintenance grant, should be appointed at the University of Bristol Agricultural and Horticultural Research Station, Long Ashton, for the extension of the research on the fungicidal action of sulphur and to assist in the study of insecticidal and fungicidal dusts.

Since these proposals, if adopted, would involve the entomologists and mycologists at the station in considerable additional work, notably in the field, it is further recommended that two new biological attendants should be provided.

The cost per annum would be :—

	1st year.	5th year.	10th year.
	£	£	£
1 Chemist (Grade III) .. .. .	320	380	380
1 Physicist (Grade III) .. .. .	320	380	380
Superannuation .. .. .	64	76	76
	<hr/>	<hr/>	<hr/>
	704	836	836
Maintenance (including wages of 1 chemical and 2 biological attendants) .. .. .	500	500	500
	<hr/>	<hr/>	<hr/>
Total cost per annum .. .. .	1,204	1,336	1,336

E. The work carried out by Dr. W. Goodwin, at the South Eastern Agricultural College, Wye, Kent, on fungicides (particularly spray-fluids containing polysulphides) and on mixed fungicides and insecticides, has already given results of great value. The Committee recognises that Dr. Goodwin, as Advisory Chemist, has other duties in addition to undertaking research, and is anxious to see assistance provided so that these investigations can be continued and extended.

It is therefore recommended that an assistant chemist (Grade II) with an appropriate maintenance grant, should be appointed at the South Eastern Agricultural College, to enable Dr. Goodwin to extend his work on fungicides and mixed fungicides and insecticides. The Committee hopes that funds would be available from the College itself which could be used for the appointment of a mycologist.

The cost per annum would be :—

	1st year.	5th year.	10th year.
	£	£	£
1 Assistant Chemist (Grade II) .. .. .	425	505	605
Superannuation .. .. .	43	51	61
	<hr/>	<hr/>	<hr/>
	468	556	666
Maintenance (including wages of a lab. attendant)	200	200	200
	<hr/>	<hr/>	<hr/>
Total cost per annum .. .. .	668	756	866

A summary of the Recommendations is appended (Annexure III).

10. Certain final questions remain to be dealt with : (a) the method by which the several groups of workers proposed under the scheme should be kept in touch with one another, (b) the means whereby discoveries made may be utilised to the fullest extent throughout the Empire.

(a) In regard to the first question, it is suggested that periodical meetings between the workers concerned should be arranged. Successful conferences of this kind are now held by the virus workers.

If it seems desirable that the whole work should be kept under survey, by some such committee as that presenting this report, liaison could then readily be arranged with individual workers or organisations (for example, the Joint Committee of the Department of Scientific and Industrial Research and Medical Research Council for chemotherapy) concerned with related lines of work such as the testing and investigation of disinfectants (bactericides, etc.) and drugs.

(b) The actual facts discovered by workers under the scheme will, it is assumed, be first published in recognised scientific journals, but this alone will not secure their full utilisation in overseas countries. Materials found to have insecticidal and fungicidal properties and which appear likely to be utilisable in practice, should be actually tested overseas, and with this end in view, sufficient quantities would have to be manufactured and sent to the country desiring to test. As the funds required for this purpose will probably be small, it seems needless at this stage to propose any financial provision. It can only be suggested that workers under the scheme should, quite apart from published articles, prepare reports on the properties of materials tested, copies of which reports should be sent to the Directors of the Imperial Bureaux of Entomology and Mycology, who could then arrange with overseas entomologists and mycologists for any further tests needed.

11. The Committee believes that the appointments proposed in the Recommendations and the sums suggested for salaries, maintenance, and capital expenditure are the minimum that will suffice to put work on insecticides and fungicides on a proper foundation in this country and enable the recommendations of the Imperial Agricultural Research Conference adequately to be implemented. The scheme proposed would transform the present series of scattered efforts into an efficient organisation ensuring co-operation, concentration and continuity in much needed research, the results of which would be beneficial not only to the various parts of the British Empire, but also to the world at large.

12. The Committee wishes to express sincere thanks to the Secretaries and to put on record its appreciation of their work.

(Signed) J. C. FRYER (*Chairman*).

" V. H. BLACKMAN.

" E. J. BUTLER.

" J. T. HEWITT.

" G. H. PETHYBRIDGE.

" J. C. PHILIP.

C. T. GIMMINGHAM }  
J. H. STEWARD. } *Joint Secretaries.*

*The 11th October 1929.*

## ANNEXURE III.

*Summary of Recommendations.*

Recommendation.	Object.	Institution.	Cost per annum.			Estimated Capital Expenditure.
			1st year. £	5th year. £	10th year. £	
A ..	Team of workers for exploration of the chemical field (see Sections 7 and 8).	Research Station, East Malling.	3,869	4,397	4,947	£ 4,000
B ..	Physico-chemical investigations	Horticultural Research Station, Cambridge.	502	568	568	
C ..	Investigation of Mode of action of insecticides.	Rothamsted Experimental Station, Harpenden.	1,573	1,771	1,963	
D ..	Investigations on the fungicidal action of sulphur and of fungicidal and insecticidal dusts.	Agricultural and Horticultural Research Station Long Ashton.	1,204	1,336	1,336	
E ..	Extension of investigations on known fungicides and mixed fungicides and insecticides.	South Eastern Agricultural College, Wye, Kent.	668	756	866	
Total ..			7,816	8,828	9,680	4,000

## ANNEXURE IV.

LETTER FROM MR. A. C. D. RIVETT, CHIEF EXECUTIVE OFFICER, COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH, TO MR. C. T. GIMINGHAM, PLANT PATHOLOGY LABORATORY, HARPENDEN, HERTS, DATED AUSTRALIA HOUSE, STRAND, LONDON, THE 25TH AUGUST, 1930.

I have read with very much interest the Report of the Insecticides and Fungicides Committee to the Minister of Agriculture and Fisheries. The matters discussed by the Committee have very great interest for the Australian Council for Scientific and Industrial Research. We have, perhaps, been inclined during the last year or two to expect too much from methods of biological control of insect pests. Experience is showing us that it is easy to exaggerate the possibilities in this direction, and there is no doubt we shall be thrown back more and more upon measures involving the use of chemicals.

I feel sure that I cannot make any comments of value. In connection with most of the scientific work which goes in Great Britain my first impression is always one of some wonder that it succeeds as well as it does, in view of the

way in which it tends to be distributed. Under the scheme suggested by the Committee, work on Insecticides and Fungicides will be carried on at five more or less independent places, and there will be no single leadership, unless some committee be appointed to keep the whole work under survey. In Australia such division of work would tend towards weakness, but I have come to the conclusion that there is something in England which makes successful schemes which apparently suffer from many disadvantages. Possibly the small distances which separate workers here have something to do with it, but, whatever it is, distribution of effect does not seem to lead to the unsatisfactory results one sometimes finds elsewhere.

All I would like to say is that we in Australia will be very glad indeed to do anything in our power to test on a large scale insecticides and fungicides which seem likely to be of value. We have a Standing Committee on Agriculture associated with the Council for Scientific and Industrial Research. The members of this Committee are the permanent heads of the State Departments of Agriculture, and through them it is very easy to arrange for quite big field tests in any of the States.

The question of financing this work is, of course, not my business, but might I venture to suggest the advisability of bringing into it some of the bigger firms which are interested in the production of insecticides. Messrs. Cooper, McDougall and Robertson for example, have already shown willingness to help us in Australia in some of our work, and I know that they are very deeply interested in any investigations likely to lead to increased use of insecticides and fungicides. They might very well be prepared to assist in meeting some of the costs of the work suggested by the Committee.

#### ANNEXURE V.

LETTER FROM P. J. DU TOIT, DIRECTOR OF VETERINARY SERVICES, TO MR. C. T. GIMMINGHAM, O.B.E., B.Sc., PLANT PATHOLOGICAL LABORATORY, MILTON ROAD, HARPENDEN, HERTS, DATED SOUTH AFRICA HOUSE, TRAFALGAR SQUARE, LONDON, THE 23RD AUGUST 1930.

I have just received your letter, P. L.-22610, of the 22nd August with the Report of the Insecticides and Fungicides Committee. I am on the point of leaving for Switzerland and have of course not had sufficient time to read the Report. I have, however, glanced through it and feel sure that I shall be able to endorse very heartily the recommendations you make. I shall take the Report with me and study it more carefully and shall then let you have my detailed comments after my return to London.

In the meantime I just wish to refer again to the point which I mentioned in my letter of the 18th August to Dr. Fryer. I think that the point should be elaborated in the report. I take it for granted that the original intention was that the Committee should not necessarily confine its attention to the insect pests of plants but should also consider the problem of insecticides for the destruction of the ecto-parasites of animals. I told you that the Empire Marketing Board had made a considerable grant to Onderstepoort for the purpose of studying this latter problem, particularly the destruction of ticks. My point now is that in this work Onderstepoort should collaborate as closely as possible with the team of workers you propose to appoint under your present scheme. It will be impossible for us at Onderstepoort to do any chemical work on a large scale. This work can be done far more effectively by the men you propose to appoint in this country. But what we can do at Onderstepoort is to

test out on a large scale and under natural conditions, any chemicals which may be recommended by the chemists at this end.

I should be glad if you would bear this point in mind and discuss it with Dr. Fryer upon his return to Harpenden.

#### ANNEXURE VI.

1. In India, crop pests and diseases do an incalculable amount of damage. The cropped area of about 260 million acres comprises hundreds of thousands of holdings most of which do not exceed five acres in area. These holdings are occupied by cultivators nine-tenths of whom are illiterate. They regard crop pests and diseases as outward manifestations of the displeasure of their deities. To get them to take concerted action in dealing with such diseases and pests is not an easy matter. Within the last twenty-five years departments of agriculture have by propaganda and demonstration done much in the district to enlighten the villagers with respect to the life histories of insect pests and fungi, and in some villages there are landholders who take an intelligent interest in this and other scientific aspects of agriculture. The number of such men is still small: in the villages in which they are to be found they are the recognised leaders in every forward movement. As the number of such men increases, it will become easier for departments of agriculture to get the villagers to co-operate in the application of preventive and remedial measures including the use of fungicides and insecticides. The mere handful of mycologists and entomologists employed in India have up to the present devoted most of their time to systematic work. They have worked out the life histories of the insects and fungi which are of economic importance, and have in some cases devised methods of checking their ravages. For example, the incidence of smut in *juar* (sorghum vulgare) has in some districts been materially reduced by treating the seed before sowing with a solution of copper sulphate. But speaking generally fungicides are as yet used only on a very small scale in India, and insecticides are scarcely used at all. On the other hand considerable progress has been made in selecting or breeding disease-resistant varieties of some of the staple crops. Wheats which are relatively immune to rust, sugar canes which are immune to Mosaic diseases and cottons which are almost immune to wilt have been evolved. In some cases, too, exotics have been introduced which have proved resistant to, or tolerant of, the diseases which indigenous varieties of the same crop are heir to.

2. The detailed recommendations made in the report of the Fungicides and Insecticides Committee are sound. The Research Station at East Malling should prove to be a very suitable centre for team work on mycological, entomological and physiological problems. I visited that Station lately, and formed a high opinion of the work being done there. With respect to the proposal made in paragraph 10 (a) [Annexure II] I am inclined to think that the Executive Council of the Imperial Agricultural Bureaux should be consulted regarding the constitution of the Committee referred to in this paragraph. That Council administers the affairs and controls the funds of eight Imperial Agricultural Bureaux whose functions are more or less similar to those of the Bureau of Entomology and Mycology. As the Bureau of Fruit Production is attached to the Fruit Production Station at East Malling, it would make for more effective co-operation if that Bureau and the organisation proposed in paragraph 7 of the report (Annexure II) were to be controlled by the same Council. It is reasonably certain, I think, that the Governments which contribute to the funds of the Bureaux of Mycology and Entomology will take steps sooner or later to have

their contributions to the funds thereof controlled by the Executive Council of the I. A. B. on which they have their representatives. The Directors of these Bureaux would welcome such an arrangement, I presume, as it would make for more effective co-operation between their staffs and those of the other eight Bureaux.

(Sd.) D. CLOUSTON.

ANNEXURE VII.

*Copy Minute.*

Letters from Dr. Rivett and Dr. du Toit are attached and a memorandum from Dr. Clouston. Mr. Gimingham and I have further discussed the subject with Dr. Rivett and Dr. du Toit. The three referees are each entirely in favour of the scheme and each makes certain suggestions or criticisms.

*Dr. Rivett* expresses the view that Australia would gladly co-operate in the testing of potential new insecticides and fungicides; he feels that the Australian entomological organisation banked too heavily on the methods of biological control and that assistance in developing the methods of chemical control would be both opportune and welcome. He is evidently inclined to question the wisdom of distributing the work through so many stations, but concludes that there is something inherent in England which tends to counteract the disadvantages of extreme decentralisation. In his letter he suggests the possibility of financing the scheme in part by contributions from the insecticide and fungicide manufacturers, but in conversation he was not inclined to press this suggestion in view of the difficulties in providing contributors with any *quid pro quo* in the shape of early or exclusive information as to results. He also, however, made the useful suggestion (which has already been before the Committee) that the research ought to be closely associated with that carried out by Professor Morgan at Twickenham on chemicals of therapeutic value.

*Dr. du Toit* has endorsed the favourable opinion given in his letter, and he has also emphasised the extreme desirability from his point of view of widening the scheme so as to enable it to include chemicals likely to be of value in the control of ecto-parasites of animals. He saw no prospect of carrying out in Africa a systematic survey of the whole chemical field and considered this must be done in England. At present South Africa depends for such work on the research carried out by commercial firms, many situated in Germany and Austria, and there were definite disadvantages in this dependence. On the whole, he would prefer that the small scale tests on animals should be carried out in England, leaving the large scale tests to Onderstepoort. If the former proved a difficulty, he could probably arrange to undertake both tests.

*Dr. Clouston* upholds the Committee's proposals in regard to East Malling. He suggests that the work should be linked with that of the Bureaux through the Bureaux Executive Council. He is evidently unaware of some of the difficulties in the situation but we have not discussed this aspect of the matter with him as the object underlying his suggestions could clearly be met in one way or another.

(Sd.) J. C. F. FRYER.

The 18th October 1930.



## ANNEXURE VIII.

We are dealing here with an important general question raised by the Empire Marketing Board and which has a bearing on the question of the Empire co-operation in agricultural research, which had previously been referred to us separately and which is coming up at the next meeting of the Advisory Board for discussion. This is the first particular example, arising out of the general case which the Empire Marketing Board have referred to different parts of the Empire for opinion. I suggest that we refer the matter to the Advisory Board as part 2 of the reference which we have already decided to place before them.

2. The scheme of research is in itself a very important one. Its origin lies in a recommendation of the Imperial Agricultural Conference of 1927 and its basis is a report of a committee appointed by the English Ministry of Agriculture to work out definite proposals for giving effect to that recommendation.

3. The scheme itself is an excellent one and it is unfortunate that it has been so delayed at every stage and finally came forward at a time when there is little chance of the Empire Marketing Board adopting it at present. Not only does the scheme involve capital expenditure of £4,000 plus recurring expenditure of £8,000 per annum (rising to £10,000 per annum at the end of 10 years) but also it involves an extension of the activities of certain English research stations especially of East Malling. At the time when I visited these stations last September—October, they were going through a very anxious time as the threatened reduction of Empire Marketing Board grants, consequent upon a smaller Parliamentary grant, was causing great anxiety. Both East Malling and Long Ashton research stations had previously undertaken extensions on the basis of Empire Marketing Board grant but were faced with the prospect of having to reduce their scientific staffs through lack of funds for running expenses. To what extent they were able to surmount their difficulties, I do not know but I think it unlikely that even when funds are available, the East Malling Research Station will be willing to undertake the new responsibilities proposed except with very much more definite guarantees than have been forthcoming hitherto on such schemes.

4. Of the value of such work to India there is no doubt. As much as any country, we need cheaper insecticides and fungicides. Secondly, India is a possible source of supply of the various barks, etc. which are likely to be used. Moreover, it is not unlikely that we may be in a position to collaborate actively in the actual work. The Mysore Research scheme on insecticides would lend itself admirably to such imperial co-operation.

5. It is suggested that our reply to the Empire Marketing Board should be on the following lines :—

- (a) that the I. C. A. R. entirely approves of the general scheme of research proposed which is the result of the recommendation of the Imperial Agricultural Conference of 1927. The results of such work would be of assistance to India and there is a possibility of establishing active collaboration with the proposed central team by taking up the study in India of certain potential insecticides.
- (b) It seems unlikely that the whole scheme can be financed at present or if, at the present juncture research stations concerned will be

willing to undertake the new responsibilities proposed. Until the full scheme can be developed, it is important however that there should be no lack of continuity in work which is already in progress. The work in the Insecticide Section at Rothamsted in particular should be supported for, as the Committee appointed by the English Ministry of Agriculture pointed out, progress has been hampered hitherto by the fact that investigations on insecticides have been too much limited to the work of entomologists. Dr. Tattersfield has done pioneer work from the bio-chemical aspect. Important work has also been done on the Long Ashton Fruit Research Station which also has special facilities for development and work there should be supported.

(Sd.) B. C. BURT.

*The 4th January 1932.*

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## APPENDIX XXVII.

## SUBJECT No. 3.

## THE INVESTIGATION OF INDIAN FISH POISONS AND OTHER INDIAN FOREST PRODUCTS FOR THEIR INSECTICIDAL PROPERTIES.

Attention is invited to the attached scheme (Enclosure) for the investigation of Indian Fish poisons and certain other Indian Forest Products from the standpoint of their insecticidal properties, received from the Government of His Highness the Maharaja of Mysore. The scheme involves a total expenditure of Rs. 15,288 spread over a period of 2 years and is submitted for the consideration of the Advisory Board.

2. Correspondence with the Indian Trade Commissioner confirms the fact that there is a keen demand for *Derris* root which is an insecticide of growing importance. Two varieties of *Derris*, viz., *Derris elliptica* and *Derris Mallacensis* are known to be of high insecticidal power. The most common Indian species of *Derris* (*Derris uliginosa*) has been examined once and found inactive but the representative character of the sample was not beyond doubt. The examination of representative samples of *Derris uliginosa* for rotenone content and insecticidal value is a matter of some urgency as some is already being exported.

3. Very extensive work on this group of poisons has been done at the Rothamsted Experimental station and if the Board decides to support this scheme it may be further considered if an effort should be made to secure the assistance of Rothamsted through the Empire Marketing Board.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

*The 31st December 1931.*

## ENCLOSURE.

## THE INVESTIGATION OF INDIAN FISH POISONS AND OTHER INDIAN FOREST PRODUCTS FOR THEIR INSECTICIDAL PROPERTIES.

With the increasing use of insecticides in the control of pests, entomologists for the last two decades have been searching in various directions for substitutes which are equally or more effective and cheaper than the ones in use. One of these lines has been the investigation of pyrethrum which has been long known as a powerful insecticide and is the main ingredient of several patent preparations. The value of it has been so highly appreciated that cultivation of the plant hitherto confined to Japan, Persia and Turkey has been extended to France and England and the active principle, pyrethrin, has been extracted and has been in use as an insecticide.

Among fish poisons, '*Derris elliptica*' a plant met with in the Malaya States and Java has been tested and the active principle in it, viz., rotenone, has been extracted and used as an insecticide. So valuable has it proved as an insecticide that plantations have been formed in the Malay States for the growth and export of the raw material to the United States where there is a good market for it. It is also used locally on many plantations of which a portion is set apart for its cultivation.

Following these researches, a beginning was made in Mysore four years ago with the collection of fish poisons used locally and no less than 16 have been collected. On one of these, research has advanced sufficiently far for it to be used as an insecticide against common pests, viz., aphids and mango hoppers. Only water extracts and dust have been used and both have been found very effective in repeated trials both as a contact poison and as a stomach poison. Dusting with bark powder has proved effective also against mosquito larvae, both culex and anopheles, and against blood worms in collections of water which are not more than six inches deep. Experiments quite recently have indicated that the powder can be used to control certain coffee pests. These valuable properties having been established, researches have been commenced to isolate the active principle. It has proved to be rotenone and experiments with it on a small scale have proved equally successful.

The plant which yields this insecticide is found in the dry land tracts of Bombay, Mysore and Madras and probably Hyderabad, and it is easily cultivated. The same compound has been extracted from another plant far more common but the yield is less. In a similar way, the other plants collected, about 16 in number, have also to be tested, and the insecticidal portion, if any, extracted.

Aside from the fish poisons, there are a number of seeds which yield hydrocyanic acid on the decomposition of the glucosides in them. Of these, one has already been tested and it is likely to be of very great use against insect pests in the stores and in the soil against which are being used hydrocyanic acid gas and other chemicals which are not only costly but dangerous to handle. These seeds are forest products for most of which there is, at present, hardly any market. Their use as insecticides would place within the hands of the raiyat a material which is cheap and at the same time less dangerous to handle.

A third line of investigation has also been opened up in regard to essential oils yielded by certain wild plants of which the smell is deterrent to pests. Of these, one is likely to prove useful for quieting bees when handling hives and possibly against eye flies. Tests are in progress to ascertain more definitely its properties. There are two others already in view which may also yield oils useful against insects and there are a very large number more which remain to be collected of which a few may have properties of a similar nature.

While, in regard to the first group mentioned, the work in Mysore has followed the lead given by America and Europe, in respect of the second and third, the investigations are the first of their kind ever attempted. It need hardly be pointed out that these three lines of investigation are of great importance from the scientific as well as the economic standpoint.

If the investigations prove as fruitful as anticipated, they will, when completed, give the Indian cultivator a series of useful insecticides and insect repellants which are cheap and effective, and the forest departments will have opened up to them a new source of revenue from plants hitherto considered as of no economic importance. For there is a very great demand for insecticides of this description in America and in Europe.

The investigation of these resources of Indian forests is of all-India importance and therefore is eminently a subject for financial aid from the Imperial Research Fund. I, therefore, submit a scheme for consideration by the Imperial Research Council.

Before dealing with the scheme, however, it is necessary to describe briefly the lines of investigation required. There are two aspects to the investigation, the entomological and chemical.

It is necessary in the first place to ascertain and collect through local agencies the plants that are commonly used as fish poisons, to have detailed information as regards their distribution, availability and methods of use. These plants will have to be subjected to preliminary tests to ascertain their insecticidal properties and the compounds responsible, if there are any, have to be located in the tissues by means of micro-chemical tests. Such of them as stand the tests satisfactorily will be made over to the organic chemist. He has to extract the active agent in the plants. From these laboratory tests, he has to evolve a method which can be used for extraction on a commercial scale. In the course of these laboratory tests, entomological tests will have to be made from time to time :

- (1) To test the insecticidal properties of the extract as obtained by various methods, make comparisons with a view to ascertain which method is the most successful producing the least change in the process of extraction ;
- (2) To test the residues to see whether any of the active agent is left over unextracted.

The more important experiment of the entomologist comes at the stage when the extract by the best method has been made. It will be then his duty to ascertain by actual tests which is the least expensive and the most successful, and to fix the strength at which it is to be used against various insect pests.

As will be seen, the work on the chemical side may be confined to laboratory experiments to extract the active agent by various methods and fix upon the cheapest and most effective way of extraction. The work would be more or less on the same lines as has been carried on till now. The requirements by way of staff and equipment would be small. If, on the other hand, the work has to be done on a commercial scale, large and comparatively costly apparatus would have to be installed and additional staff and a separate building would be required.

On the entomological side, the work would be much the same under both the schemes and cost of apparatus would also be about the same.

On the botanical side, the work need not be carried on intensively and no special staff would be necessary.

I believe that investigations should be restricted to a laboratory scale in the first instance. I consider that investigations extending over two years will give us fairly definite information on the possibilities of developing a local industry and therefore append details of cost for a small scheme for this period. I may point out here that the United States Department of Agriculture are at present spending very large sums on the investigation of Derris and Tuba as sources of insecticides and that both of these plants have to be imported into America from tropical countries. It seems highly desirable that a country such as India which has a very large number of plants as potential sources of similar insecticides should take up the investigation. I may point out that in Mysore we have a well equipped Entomological Section which has already taken up the work and also a thoroughly trained Bio-Chemist in the person of Dr. B. T. Narayanan, Ph.D. (London), to direct the investigations from the chemical side. The staff and equipment asked for would be simply supplementary to our present staff and equipment.

The following are the details for the grant of Rs. 15,288 applied for :—

<i>Chemical Section.</i>	<i>First year.</i>	<i>Second year.</i>
	Rs.	Rs.
Laboratory apparatus and chemicals ..	4,000	2,000
One Assistant Chemist on Rs. 100 p. m. ..	1,200	1,200
Contingencies .. ..	200	200
<i>Entomological Section.</i>		
One Assistant Entomologist on Rs. 100 p. m.	1,200	1,200
One Fieldman on Rs. 40 p. m. ..	480	480
One Maistry on Rs. 25 p. m. ..	300	300
Two Labourers on Rs. 11 p. m. each ..	264	264
Contingencies (including cost of collection of materials) .. ..	500	500
Apparatus .. ..	500	500
Total ..	8,644	6,644

Grand total for two years' Rs. 15,288.

LESLIE C. COLEMAN,

*Director of Agriculture.*

## APPENDIX XXVIII

## SUBJECT No. 4.

**APPLICATION FROM THE GOVERNMENT OF MADRAS FOR A GRANT OF RS. 49,930 SPREAD OVER A PERIOD OF FIVE YEARS FOR THE EXTENSION OF WORK ON ANIMAL NUTRITION IN THE MADRAS PRESIDENCY.**

Attention is invited to the attached application from the Government of Madras (Enclosure) for a recurring grant of Rs. 49,930 spread over five years for the extension of work on animal nutrition in cattle farms at Coimbatore and Hesar in that Presidency.

2. In this connection it may be stated that the Advisory Board at its meeting held in January 1931 while recommending the appointment of a Physiological Chemist in Bengal to study animal nutrition also recommended the general scheme drawn up by the Animal Husbandry Expert to the Council for the establishment of animal nutrition sections in all the major provinces. The Governing Body sanctioned the Bengal scheme, but postponed the general scheme for the present. They however agreed that where work had already been started it should be encouraged.

3. The Madras scheme is submitted to the Advisory Board for consideration.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

*The 24th December 1931.*

ENCLOSURE

COPY OF LETTER FROM S. V. RAMAMURTHY, Esq., I.C.S., M.L.C., SECRETARY TO THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT, TO THE SECRETARY, IMPERIAL COUNCIL, OF AGRICULTURAL RESEARCH, SIMLA, No. 1731-III|31-1, DATED THE 3RD JULY 1931.

At the meeting of the Governing Body of the Imperial Council of Agricultural Research which was held at Simla, on 12th May 1931, Sir C. P. Ramaswami Ayyar proposed that in provinces where work on animal nutrition had already been started, it should be encouraged and this was agreed to by the Governing Body.

2. I am to invite your attention to my letter No. 4395-III|29-5, dated the 20th March 1930, in reply to your letter No. 979, dated the 19th October 1929 (not printed). As enclosures to my letter were sent two reports by the Agricultural Chemist and the Deputy Director of Agriculture in which the work done on animal nutrition in this Province since June 1928, was described. Assistance to the work done in this Province comes therefore under the terms of Sir C. P. Ramaswami Ayyar's proposal as agreed to by the Governing Body.

3. I am directed to send herewith a letter from the Director of Agriculture, Madras, forwarding a scheme for the extension of the work on animal nutrition in this Province with the request that the scheme may be considered by the Council and the grant applied for sanctioned.

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COPY OF LETTER FROM THE DIRECTOR OF AGRICULTURE, MADRAS, R. O. C., No. D-983-31, DATED THE 17TH JUNE 1931.

I have the honour to enclose herewith a joint scheme on the expansion of work on animal nutrition submitted by the Deputy Director of Agriculture, Livestock, and the Agricultural Chemist.

2. I recommend that the scheme may be forwarded to the Imperial Council of Agricultural Research.

SCHEME FOR THE EXTENSION OF THE WORK ON ANIMAL NUTRITION IN MADRAS.

1. This scheme discusses :—

- (i) The work on animal nutrition that is now on hand at Coimbatore.
- (ii) The direction on which extension of work is desirable.
- (iii) Whether the work can be carried out more advantageously at Coimbatore ;

and submits a 5-year scheme for extending the work giving an estimate of the financial commitments involved.

2. *Work that is being done by the Government Agricultural Chemist at Coimbatore.*

(a) *Working bullocks.*—The chief problem under investigation is the determination of the digestive co-efficients for the commonly used roughages and concentrates of South India and of the requirements of bullocks of different breeds and on different levels of work. Mr. P. V. Ramiah, who is in immediate charge of these experiments has, so far, tested cholam and paddy straw as roughages and groundnut cake as the concentrate. The indications from these experiments are that the Indian Bullock is an economic consumer of food and that the protein requirement of the Ongole bullock is about a third of Armsby's standard. Thus, it has been found that the amount of protein required by a mature Ongole bullock of 1,000 lb. live weight ranges from 100 grammes for basal metabolism to 450 grammes for heavy mhoting work. Recent American work confirms the low protein requirement results obtained by us here.

The Government Agricultural Chemist's section at Coimbatore is sufficiently well equipped, staffed and financed for the continuance of this line of work.

(b) *Mineral metabolism of cattle.*—At the request of the Deputy Director of Agriculture, Livestock, the Government Agricultural Chemist prescribed in 1926 certain mixtures of bonemeal and lime for being fed to calves and to cows which had to take repeated services. In view of the satisfactory results of these trials, and in view of the very good reports made in 1928 by Sir Arnold Theiler on similar experiments in Africa systematic qualitative experiments were commenced towards the end of 1928, with calves of both sexes kindly supplied by the Deputy Director of Agriculture, Livestock. The experiments were very encouraging. The group getting bonemeal lime supplement continued to make better gains in live weight than those receiving no mineral supplement. Chemical work on the mineral metabolism could not be done for want of staff and lack of stalls for accommodating the experimental calves. The animals are, therefore, transferred to Hoar but their behaviour is being watched. Provision is made for the continuance of this work under the scheme of extension mentioned in the sequel

(c) *Manuring as affecting the nutritive value of crop.*—This work which had its origin here is very important and is of world wide interest. Independent investigations elsewhere are confirming our results. Previous work under this head was in the direction of ascertaining the effect of manuring on the nutritive value of grain, and rats were the animals used for the experiments. This work was extended last year to fodders, using rabbits and sheep as the test animals. The results confirm those of earlier experiments. An additional information is that the



digestibility of protein varied with the nature of manuring. In the new scheme provision is made for carrying out this investigation on a more intensive and extensive scale.

(d) *Applicability of results with small animals to big animals.*—As in the case of field trials, animal nutrition work requires large numbers of animals and many repetitions for conclusive results.

In experiments in which bullocks are involved the number has to be restricted on account of cost—both initial and running. Even if cost were no consideration, the large amount of rationing material required sets a limit to numbers. If small animals like rabbits could be used for tests the limitations in regard to numbers and quantity of experimental material would be negligible. But a fresh difficulty would then arise and that is whether the results obtained with small animals can be interpreted in terms of big animals especially bullocks whose digestive system is different. Keeping this in view a preliminary experiment was carried out with rabbits and sheep for testing the relative nutritive values of Guinea Grass and Elephant Grass. Both types of animals thrived better on Guinea Grass than on Elephant Grass. This experience is encouraging so far. The trials will now be extended to bullocks and if successful and practicable the method may be used as a rapid and easy way of testing the relative nutritive values and digestibilities of fodders and concentrates of different varieties and grown under different conditions.

### 3. *The lines along which extension of work is desirable.*

The lines along which work may be extended immediately are :—

- (a) A more extensive study of the mineral metabolism mentioned in paragraph 2 (b) above.
- (b) More intensive studies on the effect of manuring on the composition of food-stuffs and fodders and their nutritive values mentioned in paragraph 2 (c).
- (c) Extension of the studies on the applicability of results with small animals to big animals mentioned in paragraph 1 (d).
- (d) Studies in the nutrition of milch cattle including buffaloes, the main lines of investigation being comparative values of rations for milk, suitable rations for cows in calf and calf rearing.
- (e) *Sheep feeding for wool and mutton.*
- (f) *Poultry, value of Indian feeds.*
- (g) *Pastures, nutritive value of pastures.*
- (h) *Silage, Deep, shallow and clamp silage.*

### *Location of work.*

4. With the facilities afforded at Coimbatore by the library and well equipped laboratories for any type of research as required by a multilateral science like nutrition and in view of its utility for graduate as well as post graduate students, we are of the opinion that problems on the chemistry of nutrition should continue to be carried out at Coimbatore.

Hosur with its large herds of stock and its extensive area offers exceptional advantages for the conduct of work in which well equipped chemical laboratories and specialised staff are not essential.

For these reasons the scheme is divided into two parts. Items (a), (b) and (c) of paragraph 3 above will be carried out at Coimbatore and the Government Agricultural Chemist will be responsible for its proper conduct. Items (d) to (h) of the same paragraph will be carried out at Hosur and the Deputy Director of Agriculture, Livestock, will be in charge.

It will be observed that the problems connected with nutrition and milk production are not included in the programme of work at Coimbatore. The study of the basal requirements of adult cattle is in progress and as ration for milk production is at best a superimposition on the basal requirement it is felt that this aspect of nutrition may lie over for the present. Its importance has not, however, been forgotten and has been provided for at Hosur. It is expected that the results of preliminary work at Hosur combined with those of basal requirements studies at Coimbatore will afford data which may be taken as the basis for more exact work in the future.

*Staff and money required for 5 years for working the scheme.*

In paragraph 2 (b) it was mentioned that lack of stall accommodation for animals was one of the reasons for not continuing the work on mineral metabolism. Provision for additional accommodation for animals at Coimbatore and for a small laboratory at Hosur required by the Deputy Director of Agriculture, Livestock, is not made in this scheme as it is presumed that Government will make special allotments for these.

The following is the staff required :—

*For the Government Agricultural Chemist at Coimbatore.*

- 2 Assistants on Rs. 85—5—120.
- 1 Technical feeder on Rs. 35—1½—41.
- 1 Laboratory Attendant on Rs. 20—1—25.
- Working expenses Rs. 2,000 per annum.

*For the Deputy Director of Agriculture, Livestock, at Hosur.*

- 2 Assistants on Rs. 85—5—120.
- 1 Fieldman on Rs. 35—1½—41.
- Contingencies and working expenses Rs. 2,250 per annum.

A statement showing the yearly financial commitments for five years is submitted herewith.

FINANCIAL COMMITMENTS OF THE SCHEME

The grant of Rs. 50,000 given by the Imperial Council of Agricultural Research will be spent as follows :—

	1st year.	2nd year.	3rd year.	4th year.	5th year.	
	Rs.	Rs.	Rs.	Rs.	Rs.	
<i>I.—At Coimbatore.</i>						
2 Assistants at Rs. 85—5—120 ..	2,040	2,160	2,280	2,400	2,520	
1 Technical feeder on Rs. 35—1½—41 ..	420	438	456	474	492	
1 Laboratory attendant, 20—1—25 ..	240	252	264	276	288	
Working expenses .. ..	2,000	2,000	2,000	2,000	2,000	
<b>Total ..</b>	<b>4,700</b>	<b>4,850</b>	<b>5,000</b>	<b>5,150</b>	<b>5,3 00</b>	<b>25,000</b>
<i>II.—At Hosur.</i>						
2 Assistants on Rs. 85—5—120 ..	2,040	2,160	2,280	2,400	2,520	
1 Fieldman on Rs. 35—1½—41 ..	420	438	456	474	492	
Working expenses .. ..	2,250	2,250	2,250	2,250	2,250	
<b>Total ..</b>	<b>4,710</b>	<b>4,848</b>	<b>4,986</b>	<b>5,124</b>	<b>5,262</b>	<b>24,930</b>
<b>Total of I and II ..</b>	<b>9,410</b>	<b>9,698</b>	<b>9,986</b>	<b>10,274</b>	<b>10,562</b>	<b>49,930</b>

COPY OF LETTER FROM THE SECRETARY TO THE GOVERNMENT OF MADRAS, DEVELOPMENT DEPARTMENT, MADRAS, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. 2044-III|31-1, DATED THE 31ST JULY 1931.

*Scheme for the extension of work on Animal Nutrition.*

In continuation of my letter No. 1731-III|31-1, dated 3rd July 1931, on the above subject, I am directed to enclose the details for the amounts provided for under "Working Expenses".

A.—For Government Agricultural Chemist, Coimbatore.

	Rs.
Amount provided as working expenses .. .. .	2,000
<i>Details—</i>	
Cooly labour 3 men at Rs. 15 per mensem .. .. .	540
Feeding charges for 12 animals at Rs. 10 per head per month ..	1,440
Miscellaneous .. .. .	20
Total .. .. .	<u>2,000</u>

B.—For Deputy Director of Agriculture, Livestock, Hosur.

Amount provided .. .. .	2,250
<i>Details—</i>	
Cost of concentrates at Rs. 150 per month for one year ..	1,800
(Supplement to the Departmental budget).	
Cost of apparatus and chemicals .. .. .	450
Total .. .. .	<u>2,250</u>

## APPENDIX XXIX.

## SUBJECT No. 11.

**SCHEME FOR AN ECONOMIC ENQUIRY INTO THE COST OF SUGAR-CANE PRODUCTION IN THE UNITED PROVINCES, NORTH BIHAR, BOMBAY, THE PUNJAB AND MADRAS. REVISED PROPOSALS FOR THE CARRYING OUT OF AN ENQUIRY INTO THE COST OF PRODUCTION OF SUGARCANE, COTTON AND ROTATION CROPS.**

In paragraph 6 of their interim report (not printed) the Sugar Committee considered the question of the cost of production of sugarcane in different parts of India. They came to the conclusion that the results of such an enquiry would be of value to the Council by enabling it to decide in what areas the sugarcane industry had the best prospects of development and in what places, and in what manner, funds for research and experimental work could best be allotted. They added that an enquiry of this nature must necessarily be conducted by a special staff which would include :—

- (1) An Economist to plan the enquiry, assist in the drafting of the questionnaire and work out the details ;
- (2) An Assistant Economist in each tract to control the work of the investigators ;
- (3) Three village investigators for each tract under study to make the primary village enquiries. After describing the general scheme of the enquiry, they recommended that no action should be taken in this matter till they had considered it further at their next meeting (January 1930).

2. The Committee were unable to dispose of this question at their second meeting held at New Delhi in January 1930 ; it was accordingly considered at the third meeting of the Committee held at Poona in August 1930. Attention is invited to paragraph 8 of their proceedings of the 11th August 1930 (Enclosure I). There was a general consensus of opinion in the Committee that this enquiry should now be undertaken at the earliest possible moment. No change was recommended in the special staff except that the number of village investigators was raised from three to four for each province in order to provide for investigations in both irrigated and non-irrigated sugarcane areas for the four tracts, *viz.*, the United Provinces, North Bihar, Bombay, and the Punjab.

3. The subject was considered by the Advisory Board in January 1931 and the scheme approved.

4. In February 1931 the Government of Madras formally requested that the scope of the proposed enquiry should be extended to the Madras Presidency. The Vice-Chairman considered that it would be inadvisable to omit an important sugarcane growing province and one where there are possibilities of an extension of sugarcane cultivation from the scope of the proposed enquiry. As a result the estimates were revised from a total of Rs. 92,560 to Rs. 98,810 (Enclosure II). It was considered that after a questionnaire had been drawn up and an officer

appointed to conduct the enquiry, it might be possible to reduce the estimates which were merely approximate at this stage. It might also be possible to recruit a chief economist on a lower pay than Rs. 1,500 per month.

5. These proposals were considered by the Governing Body at its meeting held at Simla in May 1931 ; it was decided to refer the matter back to the Advisory Board for advice as to whether an enquiry into the cost of sugarcane production was needed, the findings on this point of the Tariff Board, notwithstanding.

6. The recommendations of the Advisory Board on this question will be found at Enclosure III.

7. In July 1931 the Secretary, Indian Central Cotton Committee, Bombay, wrote requesting the Imperial Council of Agricultural Research to undertake an investigation into the cost of production of the principal crops in the different Provinces and States of India (Enclosure IV). In the course of subsequent correspondence it was ascertained that the Indian Central Cotton Committee was prepared to co-operate financially and otherwise in carrying out the investigation. The Committee was, however, unable to say to what extent this help would be given until it was in possession of the lines on which the investigation would be carried out.

8. The subject was considered by the Sugar Committee at their fourth meeting held in December 1931 and they were of opinion (Enclosure V) that this work as a piece of fundamental research was of great importance and should be proceeded with immediately. The Committee also agreed that the Imperial Council should co-operate with the Indian Central Cotton Committee in this investigation.

9. The question was then discussed at the 24th meeting of the Indian Central Cotton Committee held in Bombay on the 14th and 15th December 1931. Copies of a note (Enclosure VI), submitted to that meeting by the Agricultural Expert and of an abstract of the discussion (Enclosure VII) are attached. The subject is now submitted for the consideration of the Advisory Board.

The present position is that the Sugar Committee have recommended co-operation with the Indian Central Cotton Committee in a study of the cost of producing sugarcane, cotton and the crops grown in rotation with sugar or cotton. The Indian Central Cotton Committee have accepted the resulting skeleton scheme indicated in the Agricultural Expert's note (Enclosure VI) and have specifically undertaken to pay half the cost of the Chief Economist. The next step is to appoint the economist and to have the detailed scheme worked out by him in consultation with the small joint sub-committee of the Indian Central Cotton Committee and Imperial Council of Agricultural Research. The Sugar Committee have recommended that the Council's share of expenditure should not exceed the cost of the original scheme, as passed by the Advisory Board, viz., Rs. 93,810.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

NEW DELHI,

*The 2nd January 1932.*

## ENCLOSURE I

EXTRACT FROM THE PROCEEDINGS OF THE 3RD MEETING OF THE SUGAR COMMITTEE, APPOINTED BY THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, HELD AT POONA ON THE 11TH AND 13TH AUGUST 1930.

8. *Enquiries into the cost of cane and gur production including enquiry into the marketing of gur.*—There was a general consensus of opinion in the Committee that this enquiry should now be undertaken at the earliest possible moment which would be about February 1931 when the sugarcane season was on. Proposals in regard to the conduct of the enquiry had already been formulated by the Committee at its first meeting in October 1929 and as it was felt that the appropriate time of enquiry was now approaching it was time to make concrete proposals in regard to the staff.

It was decided to leave the choice of the Economist who would plan the enquiry to the Chairman. A good Economist preferably with agricultural experience was what was required. The pay would have to depend upon the person selected but it was felt that it should not exceed Rs. 1,500 per mensem. The Economist should be engaged for one year with option on either side to extend his appointment to another year.

At its first meeting the Sugar Committee recommended that the four sugarcane areas selected for the enquiries should be Meerut, North Bihar, Bombay and the Jullundur District of the Punjab. It was now decided not to mention any particular place but to define the areas as the United Provinces, North Bihar, Bombay and the Punjab leaving the actual tracts to be decided upon later in consultation with the Director of Agriculture of the province concerned when the Economist joined.

As for the Assistant Economists of which there would be four it was felt that they should be Honours Graduates in Economics with some research experience the pay depending upon the person selected but not to exceed Rs. 350 per mensem.

In the original proposals three investigators were suggested for each tract. It was now pointed out that in order to provide for irrigated and non-irrigated sugarcane areas in each of the four provinces four investigators for each province instead of three would be required. These would be Agricultural College Graduates with experience of district work, especially sugarcane work. The pay of each would depend upon the man selected but it should not exceed Rs. 200.

In the matter of the control the Chairman suggested that the work should be conducted through the local Agricultural Departments. The Assistant Economists and the Investigators would be under the administrative control of the Director of Agriculture, the Economist in charge of the whole scheme who would be under the Council acting in consultation with the Directors of Agriculture concerned. This was agreed to as well as the suggestion that detailed arrangements might be left for adjustment after the Economist had joined. The Economist would be required a month or two before the local investigation started. Mr. Clarke added a rider that the administrative control of the Directors of Agriculture over the subordinate staff as well as the fact that the Chief Economist would act in consultation with Directors of Agriculture should not in any way detract from the latter's responsibility for the whole enquiry. He should be finally responsible for its conduct. This was agreed to.

## ENCLOSURE II.

## ENQUIRY INTO THE COST OF PRODUCTION OF SUGARCANE.

	Rs.
*I.—Economist at a pay not exceeding Rs. 1,500 per mensem for 15 months. (A good Economist preferably with agricultural experience) .. .. .	22,500
II.—Travelling allowance .. .. .	2,500
†III.—Five Assistant Economists at Rs. 350 for 15 months. (Honours graduates in Economics with some research experience) .. .. .	26,250
IV.—Travelling allowance at Rs. 1,000 .. .. .	5,000
†V.—Sixteen investigators at Rs. 200 for 12 months. (Agricultural Graduates with experience of District work, especially sugarcane work) .. .. .	33,400
VI.—Travelling allowance at Rs. 500 each .. .. .	8,000
VII.—Contingencies .. .. .	1,600
VIII.—Printing of Questionnaire, books and forms .. .. .	2,000
Total .. .. .	1,06,250
The rates of pay shown are the maximum approved by the Committee and we hope for some saving on investigators whose average pay should not exceed Rs. 150, a saving of about .. .. .	
	-9,600
IX.—Clerical staff for compilation (investigators will be required to assist) say 6 temporary clerks on about Rs. 60 per mensem for 6 months, Rs. 2,100 .. .. .	+2,160
Total .. .. .	98,810

\* Assuming that the enquiry lasts 1 whole season, he will be needed for 3 months extra at least.

†United Provinces .. .. .	1
Bihar .. .. .	1
Bombay .. .. .	1
Punjab .. .. .	1
Madras .. .. .	1
†United Provinces .. .. .	4
Bihar and Orissa .. .. .	4
Punjab .. .. .	4
Bombay .. .. .	2
Madras .. .. .	2
LICAR .. .. .	2 B

## ENCLOSURE III

EXTRACT FROM THE PROCEEDINGS OF THE ADVISORY BOARD, JUNE 1931.

*G. Scheme for an economic enquiry into the cost of sugarcane production in the United Provinces, North Bihar, Bombay, the Punjab and Madras.*

The Chairman explained that the Governing Body had referred back the scheme to the Advisory Board to elicit the Board's opinion whether, in view of the fact that the Tariff Board had given the cost of production of sugarcane for several areas, it was necessary to have an enquiry. Dr. Hyder did not think that such an expensive enquiry at a cost of about a lakh of rupees was really necessary. If the reason was that knowing the cost of production would help the case for protection that reason was no longer valid as protection was coming. If it was to find out what were the suitable areas in India for sugarcane cultivation that he said was quite well-known. The areas were the United Provinces, Bihar, part of the Punjab, the Bombay Deccan and Madras. Mr. Milne in reply to Dr. Hyder said that the Sugar Committee had come to the conclusion that the results of an enquiry into the cost of production would be of value to the Council by enabling it to decide in what areas the sugarcane industry had the best prospects of development and in what places and in what manner funds for research in experimental work could best be allotted. All the Directors of Agriculture present stated that the figures that Departments had supplied to the Tariff Board were not by any means accurate figures and the Tariff Board had been informed of the fact. They mostly related to the cost of producing sugarcane on Government Farms whereas what was wanted was the cost which a ryot incurred in the production of cane. Dr. Hyder suggested that the whole question be referred to the Indian Economic Association which would draw out a scheme which would be much less expensive than the one proposed. Under it young graduates from Universities would be deputed to carry out the investigation. Professor Gangulee pointed out that for such an enquiry to be of practical use it had to be carried on by people who, in addition to a knowledge of economics, knew agricultural conditions. Mr. Srivastava said that it was important for the sugar manufacturing industry to know the cost of production. The costs given in the Tariff Board's Report were admittedly unreliable because they were based on insufficient data. For example, the costs given for the United Provinces were those for the Shahjahanpur Farm whereas the bulk of the sugarcane grown in the United Provinces was much more to the East. It was reckoned that two-thirds of the cost of producing a maund of sugar was the cost of the cane. In India the cane cost from between 5 to 6 annas per maund whereas in Java it cost 2.83 annas per maund. It was difficult for manufacturers in India to take measures to reduce Indian costs unless they knew what was the cost of producing cane in India. Mr. Stewart said that accurate information as to the cost of production of sugarcane could not be had by means of the proposed questionnaire. In their report the Tariff Board had pointed out the necessity of an accurate knowledge of the cost of man and bullock labour. To obtain accurate information on these points, it was essential that accurate accounts of all expenditure and income and of all operations on a number of holdings should be kept. A complete record of the cultivation given to each field and of the time and labour expended on it had to be maintained. It was only by so doing that correct information as to labour costs could be obtained. When the information for the sugarcane crop was being collected, information regarding the cost of production of all other crops on the holdings concerned could be obtained without additional expenditure. He suggested, therefore, that this system should be adopted in preference to the inquiry by means of the proposed questionnaire, and that it should be extended to include all the crops usually grown in rotation with sugarcane. The



Chairman said that as to how such an enquiry had best be conducted was a matter which could be settled afterwards. The question which had been referred to the Board by the Governing Body was whether the figures given in the report of the Tariff Board were not good enough to go upon. It was clear from the discussion that Departments of Agriculture who had supplied these figures to the Tariff Board did not think them accurate enough to base any deductions upon. So the question before the Board was whether there should or should not be an enquiry into the cost of production of sugarcane. The Board recommended that such an enquiry should take place.

#### ENCLOSURE IV.

LETTER FROM THE SECRETARY, INDIAN CENTRAL COTTON COMMITTEE, BOMBAY, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, No. 6308 OF 1931, DATED THE 25TH JULY 1931.

##### *Investigation into the cost of growing cotton in India.*

I am directed to forward the following resolution passed unanimously at the 23rd meeting of the Central Cotton Committee held on the 13th July 1931 :—

*Resolution.*—“ In view of the difficulty of carrying out an investigation into cost of production of a single crop, and the fact that this Committee deals only with cotton, the Central Cotton Committee requests the Imperial Council of Agricultural Research to undertake an investigation into the cost of production of principal crops in the different provinces and States of India.”

When the question of giving help to the cotton grower was before a previous meeting of the Committee it was evident from the discussion that the exact cost of producing an acre of cotton was unknown and my Committee considered that this state of affairs should be remedied. It was pointed out at the recent meeting that a general investigation into costings of all crops grown in rotation with cotton would cost no more than if cotton alone were studied. As my Committee is empowered by the Indian Cotton Cess Act to deal with cotton only an investigation by the Central Cotton Committee into the cost of producing other crops is ruled out and it was decided therefore to request the Imperial Council of Agricultural Research to undertake this very important work for all the main crops of the Country. My Committee was led to believe that a proposal to study the cost of producing sugarcane was favourably considered quite recently by the Imperial Council of Agricultural Research.

#### ENCLOSURE V.

EXTRACT FROM THE PROCEEDINGS OF THE MEETING OF THE SUGAR COMMITTEE HELD ON THE 7TH DECEMBER 1931.

*Scheme for an economic enquiry into the cost of sugarcane production in the United Provinces, North Bihar, Bombay, the Punjab and Madras.*

Mr. Burt explained the present position that after the Governing Body had referred the matter back the Advisory Board had again supported the Sugar Committee's recommendation. The Committee was of opinion that this work as a piece of fundamental research is of very great importance and should be proceeded with immediately. Next the proposal of the Indian Central Cotton Committee was discussed and it was unanimously agreed that we should co-operate with the Indian Central Cotton Committee in this investigation ; to get the actual

costs of cane-growing, it was necessary to find out the cost of crops grown in rotation with cane and cotton. This was very important from the bullock and labour points of view. It was therefore agreed that we ought to go on with our enquiry and include crops in rotation provided we have not to pay more than what has been previously proposed in this connection. The control of the joint enquiry should rest with the Vice-Chairman to whom should be left the actual details regarding the shares of the cost to be borne by the Imperial Council of Agricultural Research and the Indian Central Cotton Committee respectively.

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ENCLOSURE VI.

NOTE BY THE AGRICULTURAL EXPERT, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, CIRCULATED AT THE 24TH MEETING OF THE INDIAN CENTRAL COTTON COMMITTEE, HELD IN BOMBAY ON THE 14TH AND 15TH DECEMBER 1931.

The following suggestions are put forward as a basis of discussion :—

The Sugar Committee of the Imperial Council of Agricultural Research has proposed an investigation into the cost of sugarcane production and this recommendation has been supported by the Advisory Board of the Council after a further reference to it by the Governing Body. The investigation will therefore be undertaken if sanctioned by the Governing Body of the Council. The Sugar Committee at its last meeting agreed with the proposal that instead of trying to determine the cost of production of sugarcane alone, it would be better to investigate the cost of production of sugarcane and rotation crops in order that more exact allowances may be made for the cost of bullocks and labour which would otherwise present great difficulty.

2. The Sugar Committee further recommended that the Imperial Council of Agricultural Research should co-operate with the Indian Central Cotton Committee in an enquiry into the cost of production of cotton, sugarcane and rotation crops and it left details to be settled with the Cotton Committee by the Vice-Chairman of the Research Council.

3. The principle now adopted will be that the holding will be treated as a unit and costings obtained for all the crops of the holding but with special reference to cotton and sugarcane. In other words, the main feature of the investigations will be the determination of the costs of production of sugarcane and cotton. In selecting both villages and holdings these limitations of the scheme will need to be borne in mind, otherwise the scheme would become unwieldy.

4. The agency to be employed in each province naturally will vary but the Research Council's original general scheme was as follows :—

- (a) One Economist on Rs. 1,500 per mensem (to plan and guide the enquiry and to work out the results).
- (b) One Assistant Economist at Rs. 350 per mensem in each province (to control the work within the province and to see that it keeps to the scheme laid down). The Assistant Economists would not be under the administrative control of the Chief Economist but the Principal Economist would tour freely and give the Assistant Economist all necessary assistance and technical instruction.
- (c) For each Assistant Economist in the original sugar enquiry, four Head Investigators on Rs. 200 per mensem were proposed : these should

be experienced Agricultural Assistants with a knowledge of the tract under investigation.

- (d) Provision was also made in the original scheme for travelling allowance and contingencies, printing, etc., the travelling allowance of the Principal Economist being estimated at Rs. 2,500 for a period of fifteen months; Assistant Economists at Rs. 1,000 each and Head Investigators at Rs. 500 each.

The salaries stated above were maxima.

5. The Imperial Council of Agricultural Research has welcomed the offer of co-operation from the Indian Central Cotton Committee in this important investigation into the cost of production of certain important Indian crops. Probably the best method of working would be to appoint a small joint Sub-Committee of the two bodies which would work out details of the joint scheme and which would remain in existence to assist the Economist during the course of the enquiry.

6. In order to show more clearly the scope for co-operation between the two branches of the enquiry, the following facts may be found helpful :—

- (a) In the United Provinces, it is proposed to determine the cost of sugarcane production in two tracts. One of these can quite well be a cotton tract, *viz.*, Meerut or Aligarh district. In the Punjab similarly two investigations into the cost of sugarcane production are intended one of which will be in the Canal Colonies (Lyallpur) and one probably in the South-East or Central Punjab. The first tract at any rate would also be an important cotton tract. In the case, therefore, of these two provinces, it will be quite simple to share the cost of the scheme.
- (b) In Bombay, the cost of sugarcane production is to be determined in the Bombay-Deccan Canal area which is of minor importance from a cotton standpoint. On the other hand, there are at least four important cotton tracts where cotton production should be investigated. In Madras, the sugarcane investigation is most likely to take place in the Vizagapatam district which is not a typical cotton district; there would be only one investigation in that province into the cost of sugarcane production. An alternative district in Madras will probably be Chittoor which is moderately important both from the sugarcane and cotton standpoint. As in the case of Bombay, there are important cotton tracts in Madras where costs of cotton production should be ascertained.
- (c) In the Central Provinces and Berar, there is no sugarcane worth mentioning and the investigation will deal only with cotton and rotation crops. In Bihar and Orissa, on the other hand, there is no cotton and we should have simply a sugarcane enquiry.

7. These details are to be taken as illustrative rather than final but they suggest that the following general lines of co-operation between the Research Council and the Cotton Committee are practicable :—

- (1) The Economist to direct the investigation and to ensure that it is carried out on a uniform plan, should be shared equally by the two bodies.
- (2) In those Provinces where both sugarcane and cotton are under investigation, the cost of the Assistant Economist should be shared between the Cotton Committee and the Research Council. In those Provinces

where sugarcane is the only consideration, the Research Council should provide the Economist : in those Provinces where cotton is the sole consideration, the Assistant Economist should be provided by the Cotton Committee.

- (3) Where it is possible for the same investigators to carry out both sugarcane and the cotton enquiry as is the case in certain districts of the United Provinces and the Punjab, the cost of investigation will be equally shared between the two bodies : otherwise they would be paid entirely by the Research Council or Cotton Committee according to the nature of the investigation.

A reference has been made to the fact that the provincial agency to carry out work will differ somewhat. In the United Provinces, for example, it has been proposed recently that the investigation should be carried out by the Board of Economic Enquiry. These details could best be settled by the joint Sub-Committee proposed. In addition to appointing a joint committee, it seems desirable that the Economist should be engaged as soon as possible as much of the success of the enquiry will depend on a unified scheme of investigation.

8. It is proposed, therefore, that the Indian Central Cotton Committee should now—

- (1) agree to pay half of the cost of the Economist to be appointed by the Imperial Council of Agricultural Research at a salary not exceeding Rs. 1,500 per month,
- (2) authorise the Standing Finance Sub-Committee to sanction further grants to the Imperial Council of Agricultural Research for the carrying out of the scheme on receipt of details, and
- (3) nominate representatives of the Indian Central Cotton Committee to a joint Sub-Committee of the Imperial Council of Agricultural Research and the Indian Central Cotton Committee which will work out details and guide the investigation.

B. C. BURT.

#### ENCLOSURE VII.

#### ABSTRACT OF THE DISCUSSION AT THE 24TH MEETING OF THE INDIAN CENTRAL COTTON COMMITTEE.

#### *Investigation into the cost of growing cotton in India—Reply from the Imperial Council of Agricultural Research.*

*Mr. Burt* said that the Imperial Council of Agricultural Research had decided to undertake an investigation into the cost of growing sugarcane in the main sugarcane-growing parts of India. The note which he had submitted gave in rough his ideas how this Committee and the Agricultural Research Council could co-operate and if the scheme was approved, it would be found that both the Committee and the Research Council would economise considerably. The scheme which the Sugar Committee had worked out was not dissimilar from the method which the Central Cotton Committee had adopted for investigating the marketing of cotton. He considered that an experienced Chief Economist should be obtained for laying down the lines of the investigations, for guiding the enquiry and for working up the results. Where a joint enquiry was possible, *e.g.*, in the Punjab and the United

Provinces, the cost of the investigating staff could be shared. In the Central Provinces and in Bombay the Committee would have to find its own Assistant Economist because the Central Provinces were not an important sugarcane-growing province, while in Bombay the sugarcane areas were not the same as the cotton growing areas. Similarly the Imperial Council of Agricultural Research would have to provide for Bihar and Orissa which was a sugar but not a cotton province. Put briefly, the scheme was that the two bodies should share the cost of the Chief Economist. In those provinces where a joint enquiry into sugarcane and cotton and its rotation crops was possible the Assistant Economist should be shared, while each body would bear the whole cost of the Assistant Economist in those Provinces where only the one crop was being investigated. The method of working must be thoroughly discussed and standard methods decided on; he therefore suggested that a small Sub-Committee should be appointed by the Committee to settle details and to co-operate with the Sugar Committee. The essential point was that funds should be provided now to enable the preliminary work to be undertaken.

*Mr. Jenkins* asked whether the sites mentioned in *Mr. Burt's* note were final because he wished to urge an investigation into the cost of growing cotton in Sind.

*Mr. Burt* said they were not final, and they had only been mentioned as illustrations.

*Rao Bahadur Bhimbhai Ranchodji Naik* said he whole-heartedly supported the scheme which he thought should have been done years ago. When the question of low prices of cotton came before the Committee no one was in a position to say what it cost to grow. The most authoritative information should be obtained and he hoped the investigation would be thorough so that the figures could not be challenged. He considered it was necessary for the workers to take the people into their confidence; otherwise false information would be supplied.

*Major Vanrenen* said he thought it would be difficult to determine the cost of growing sugarcane and cotton and he thought the Committee should make a representation to the Imperial Council of Agricultural Research that a much more comprehensive investigation should be made as Cotton was not usually grown in rotation with sugarcane. He had tried to work out the cost of growing cotton on his own farm but had been unable to do so.

*Mr. Burt* explained that the scheme was that the cost of growing sugarcane should be investigated and also the cost of growing cotton with its rotation crops. The only reason for combining the two was to economise in some of the staff.

*Mr. Chunilal B. Mehta* said he was very pleased that this work had been taken up though he did not think it was wise to combine sugarcane with cotton.

The Vice-President said he was glad to see that this matter had been carried a step further at this meeting. When the Committee carried out its investigations into the finance and marketing of the cultivator's crop it found itself faced with the whole question of rural economics. They had certainly brought to light certain defects in marketing which it was hoped would be put right. There was only one thing he did not like about *Mr. Burt's* note, *viz.*, paragraph 8 (2) which said "that this Committee should authorise the Standing Finance Sub-Committee to sanction further grants to the Imperial Council of Agricultural Research for the carrying out of the scheme on receipt of details". Though he was the Chairman of the Standing Finance Sub-Committee he did not think it was wise to give the Sub-Committee too much power. He would like details of the scheme to come before

the Central Cotton Committee. He agreed to the tentative proposals but he did not think it was necessary to give the Standing Finance Sub-Committee this amount of power. It would take some time to get the Chief Economist and he therefore suggested that the details should be discussed at the next meeting of the Committee in July.

Mr. Burt proposed :—

*Resolution No. 16.*—“That a sum amounting to Rs. 10,000 be provided in this year's budget for the initial expenses.”

This was seconded by Rao Bahadur Bhimbhai Ranchodji Naik and carried unanimously.

It was further decided that the question of appointing a small Committee should be left to the Standing Finance Sub-Committee.

## APPENDIX XXX.

SUBJECT No. 30.

To

The Vice-Chairman,

Imperial Council of Agricultural Research.

SIR,

I have the honour to give notice that I intend to move the appended Resolution in the Advisory Board meeting on 27th or 28th instant under item 28.

I have the honour to be,

SIR,

Your most obedient servant,

K. HEWLETT,

*Principal,*

*Bombay Veterinary College.*

27th January 1933.

*Resolution.*

(i) That this Board considers the retention of the Animal Husbandry Expert a matter of vital importance for the co-ordination and direction of research in animal husbandry and veterinary science.

(ii) It recommends that the matter of the retention of the Animal Husbandry Expert should be reconsidered by the Government of India.

(iii) If his retention is considered impossible in the present financial circumstances then this Board recommends that the cost of his appointment be debited to the Research grant of this Council.

## APPENDIX XXXI

SUBJECT No. 25.

## REPORT OF THE SUB-COMMITTEE ON THE SCHEME FOR THE ESTABLISHMENT OF AN AGRICULTURAL RESEARCH STATION AT RISALEWALA (NEAR LYALLPUR) FOR THE WATER REQUIREMENTS OF CROPS.

At its meeting held in January 1931 the Advisory Board decided to refer the scheme (not printed) for the establishment of an agricultural research station at Risalewala (near Lyallpur) for work on the water requirements of crops to the committee which was to be appointed to consider the Bombay dry-farming scheme. The scheme (not printed) was accordingly considered by the Committee in question in June 1931, and after considerable discussion it was decided that the committee should adjourn till the next meeting of the Advisory Board in order to give the Punjab Department of Agriculture an opportunity to re-examine the scheme in the light of the points raised.

2. The Director of Agriculture, Punjab, has since submitted a revised scheme (Enclosure I) which involves a total expenditure of Rs. 5,50,000 spread over a period of five years as against Rs. 7,67,000 provided in the original scheme (not printed). This was considered by the sub-committee on the afternoon of the 25th January 1932 and a copy of its report is enclosed (Enclosure II).

The scheme is now for the consideration of the Advisory Board. •

M. S. A. HYDARI,

Secretary.

The 27th January 1932.

## ENCLOSURE I.

COPY OF LETTER FROM THE DIRECTOR OF AGRICULTURE, PUNJAB, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, No. 22772, DATED THE 19TH DECEMBER 1931.

*Scheme for the establishment of an Agricultural Research Station at Risalewala (near Lyallpur) for work on the Water Requirements of Crops.*

With reference to Sir Vijayaraghavacharya's D.-O. letter No. 2098-Agri., dated 31st August 1931, I have the honour to forward herewith the revised scheme (Annexure) for investigations into the Water Requirements of Crops, after duly considering the suggestions made by the Sub-Committee of the Imperial Council of Agricultural Research, which examined this scheme in Simla in June last, and the subsequent suggestions embodied in Dr. Keen's letter received with the D. O. letter referred to above.

2. The Sub-Committee thought that some more detailed information, as to the nature of the experiments, should be embodied in the scheme and they recommended the inclusion of a post of Soil Physicist in the scheme. This post, together with the necessary staff and facilities for such an officer, has now been provided in the revised scheme, which also shows broadly the lines of work which would form the basis of the scheme to start with. These lines of work cannot be considered exhaustive and, doubtless, other important problems will present themselves for solution when the work is under way.

3. The Sub-Committee appeared to have got a wrong impression regarding the limitations that would be placed on the experimental plots by the provision of pucca khals (water courses). Possibly this arose from the somewhat detailed nature of the divisions shown on the proposed layout plan which accompanied



the scheme. The Sub-Committee agreed that for a scientific investigation of this nature the main water courses must be pucca in order to make possible an accurate measurement of the water applied, and to prevent sources of loss of water, or its addition, through seepage from neighbouring areas. The pucca water courses provided in the scheme consist of only one main water channel which will supply water to two adjoining squares, and five water channels dividing up the area of each square into blocks, of approximately 5 acres each. These areas of 5 acres can be sub-divided and utilized as desired. Therefore, it will be seen that these pucca channels do not place undue limitations on the size and shape of the experimental plots. From these channels water will be applied to the experimental plots directly and in cases where very low deltas of water are to be applied, it will be conveyed to different parts of the plots in moveable and adjustable metal flumes in order to minimise loss by seepage during application.

4. The investigations will include pot culture experiments in the laboratory, as well as investigations in the field, on problems of plant physiology and soil physics, and these two lines of investigations will proceed simultaneously.

5. In revising the scheme the cost has been reduced substantially in certain directions in the interests of economy. The reductions in cost are as follows :—

(a) The original scheme provided a sum of Rs. 1,45,020 for buildings. In the revised scheme provision is made only for the repair and alteration of such katcha buildings as already exist on the farm, and the erection of a small field laboratory and office, the provision of which is unavoidable in view of the nature of the work. All establishment which cannot be accommodated in the katcha houses to be taken over from the tenants, will find their own accommodation in the city of Lyallpur which is only three miles from the farm steading.

(b) In the original scheme it was proposed to provide pucca water courses in the whole 11 squares (300 acres) of land earmarked for this scheme. In the revised scheme these pucca channels have been provided only in 8 squares (approximately 222 acres); the land in the remaining 3 squares will be utilized in applying the results of the scientific experiments carried out on the main area to conditions in which the cultivator has to work.

(c) Since the original scheme was drafted, the cost of labour, prices of materials, etc., have fallen. These various factors have enabled the cost of laying out the land to be reduced from Rs. 2,73,185 to Rs. 1,62,416.

(d) In conformity with the 15 per cent. reduction in pay made by the Punjab Government, in cases of new appointments to the various grades, the pay of the establishment which will be recruited directly for the purpose of this scheme has been reduced, but the provision of the Soil Physicist and his staff, the inclusion of which was considered essential by the Sub-Committee of the Imperial Council of Agricultural Research, has resulted in a small increase in the total cost of establishment, according to the revised scheme.

#### ANNEXURE.

##### *Establishment of an Agricultural Research Station at Risalewala (near Lyallpur) for work on the water requirements of crops.*

The establishment of an Irrigation Research Station was under consideration as far back as 1917, when the All-India Board of Agriculture recommended that the Government of India should set up a Hydrological Station on a large scale. In 1919, at a meeting of certain Irrigation and Agricultural Officers of the Punjab, it was decided to frame a Provincial Scheme with a view to its possible future expansion into an Imperial Scheme but no progress has been made.

2. The subject of Irrigation research is a matter of immense importance to several of the Provinces in India, and whilst the results which would be obtained at any one research station in India might, owing to climatic and other conditions, not be applicable in their entirety to the whole of India, they would doubtless throw light of the greatest value, to all-India, on many problems connected with irrigation farming.

3. The present position in the Punjab is that for the past five years or so an area of 300 acres of land has been set aside on the Risalewala Seed Farm as the nucleus of such a Research Station. The farm is situated at a distance of three miles from Lyallpur City and five miles from the Agricultural College and Research Institute.

4. The investigations which would be carried out on this station during the five years for which a grant is now sought require the collaboration of an Agriculturist, a Soil Physicist, a Plant Physiologist and an Engineer. It is proposed that under the Director of Agriculture, Punjab, the Professor of Agriculture should be the Agriculturist in charge and that the Agricultural Engineer should carry out the engineering work in conjunction with the Irrigation Department. The Irrigation Expert would have full control over the hydraulic side of the experiment.

*Investigations to be carried out.*

5. In most areas where the success of agricultural operations depends on the supply of water through canals, there is apt to be a conflict between the Irrigation authorities who charge a rate per acre irrigated and wish to spread the water over the maximum area, and the cultivator who may, for his own reasons, prefer to concentrate his supply on a smaller area.

6. In irrigation farming important problems before the cultivator are :—

- (a) the optimum amount of water to use on each crop and on each field from the point of view both of outturn and of profit. He requires this information so that he may adjust his cropping in the most economical way consistent with his water supply,
- (b) the best way to distribute the water available over his crops at each canal rotation throughout the growing period of the crops, and
- (c) the extent of the loss entailed by different degrees of deviation from these ideals.

7. Inter-related with these problems of the cultivator is an important problem of the Canal Department, namely, the optimum quantity of water to allow per acre. This depends not only on the amount needed per acre of each crop, but also upon the relative profitableness of different degrees of intensity of cultivation. Obviously, it must always be a loss to the State, and generally also to the cultivator, if excess of water is applied per acre, or if the optimum intensity of cropping is not practised, or if crops are grown which will not give the most profitable return.

8. The amount of water which it is best to use and the return for the water used, depend to a great extent on the physical structure of the soil, as well as on the condition of the soil at the time of sowing and during the growth of the crop. This condition, in its turn, is closely connected with the rotation of crops grown. The object of these experiments, then, is to determine the relationship between the amount of water applied per acre to each of the important canal colony crops, and the yields of these crops, together with the investigation of other closely allied problems bearing on irrigation farming.

9. Amongst others the following lines of investigation will be undertaken :—

- (a) the water requirements of crops under various conditions of soil, cultivation, rotation, etc.;
- (b) the economics of different systems of irrigation and the cost of water in these various systems ;
- (c) the methods and times of application of irrigation water ;
- (d) the effect of physical and cultural factors on the loss of water from the soil, and
- (e) the effect of different meteorological conditions on water requirements of crops.

*Agricultural Section.*

10. The experiments which will be laid out will be devised to provide information on the following points :—

- (i) the effect of varying numbers of irrigations of the same depth (3 inches) on the yields of each of the principal crops and on the quality of the produce ;
- (ii) the effect of frequent light irrigations, compared with that of heavy irrigations at longer intervals (the total quantity of water applied in both cases being the same) on the yields of the principal crops and the quality of the produce ;
- (iii) the effect on the yield of the crop and the quality of the produce of applying equal quantities of water but varying the time of applying the water ;
- (iv) the effect of deep and shallow preparatory tillage on the conservation of soil moisture ;
- (v) the effect of inter-culture on the conservation of soil moisture ;
- (vi) (a) the degrees of unevenness of distribution of water which take place when farmers irrigate plots cultivated by different methods ;
- (b) the best way to prepare irrigated land in order to enable the cultivator to spread the water supply over the largest area ;
- (vii) the best shape and size of "kiari" for different discharges of water common on farmers' lands ;
- (viii) the optimum depth of single irrigation for particular purposes ;
- (ix) (a) the relative quantities of water required to irrigate land when—
  - (1) flat,
  - (2) ridged,
- (b) the comparative yields of the main crops under these two conditions of cultivation when equal quantities of water are applied to both ;
- (x) the water requirements of manured crops as opposed to crops unmanured ;
- (xi) the application of the scientific results obtained to suit zamindari conditions and practice.

*Plant Physiology Section.*

11. In this section the investigations would include a study of—

- (a) the water requirements of the various crop plants grown with special reference to transpiration, and the quantity of water required to produce a unit of dry matter ;
- (b) the root range of crops under various field conditions ;
- (c) the reaction of plants of the principal crops to meteorological conditions of wind, temperature, humidity and sun-shine.

The work done in this section includes experiments in both the laboratory and the field.

*Soil Physics Section.*

The experiments will include—

- (a) a study of the movements of moisture in the soil ;
- (b) a study of the ultimate disposal of irrigation water on fallow and cropped land, including losses through evaporation, percolation, etc., under various conditions ;
- (c) a determination of the optimum percentage of free moisture in the soil for plant growth ;
- (d) a study of the minimum amount of moisture required in the soil for plant growth ;
- (e) the correlation of the results of field experiments with the physical and chemical properties of the soil.

The work in this section involves investigations both in the laboratory and in the field.

*Lay out of land.*

In the Canal Colonies a square consists of 25 killas (27.8 acres) and is divided by five water courses as shown in the sketch attached. For the purpose of the present scheme these five water channels must be made pucca in order that the irrigation water supplied to the crops may be accurately measured and that additional sources of supply, such as seepage, as well as loss by absorption from katcha channels may be eliminated. The main water course will also be pucca and will serve the two squares on either sides of it. No other pucca channels are required, the blocks of five killas between channels being sub-divided into smaller plots by making bunds of earth as required according to farming practice.

It is considered that pucca channels will have to be provided in an area of eight squares to carry out the scientific experiments in view. In the remaining three squares of land provided for the scheme, no pucca channels will be made, and this area will be used to adjust the scientific results obtained in the main area, to ordinary farming practice.

The installation of measuring weirs within each square, and of iron outlets and water level recorders, is necessary for the proper measuring of the water used.

The cost of laying out the land and constructing the pucca water courses is estimated to be Rs. 1,62,416.

*Buildings.*

In order to reduce the cost of the scheme to the minimum, it is proposed to utilize, wherever possible, such katcha buildings as already exist on the farm. These buildings require a small expenditure to convert them to the purpose for which they are required, and to make them habitable for such of the staff as will be housed within them. The Extra Assistant Director of Agriculture, in charge of the experiment, will be housed in the rest-house which exists on the farm, and such of the remaining staff as are required by the nature of their duties to be resident on the spot, will be accommodated in other buildings already at the Farm. Much of the laboratory work will be done in the laboratories of the Agricultural College and Research Institute situated at a distance of 5 miles from the farm; but the provision of a small field laboratory, with office accommodation, is indispensable, so that such laboratory work as is necessary may be carried out on the farm itself. It is estimated that the total cost of putting the existing buildings in order and constructing the field laboratory, office and store will not exceed Rs. 11,675. There will be a small recurring expenditure for the upkeep of these buildings.

*Staff.*

The provision under this head includes the appointment of the following superior staff :—

- An Extra Assistant Director of Agriculture,
- A Soil Physicist,
- A Plant Physiologist, and
- An Assistant Engineer.

The Extra Assistant Director of Agriculture will be in charge of the experimental work under the orders of the Professor of Agriculture. The Assistant Engineer will carry out the engineering side of the investigation under the Agricultural Engineer to Government and in conjunction with the Irrigation Department. He will also be responsible for the exact measurement and application of the water.

The staff also includes a Statistical Assistant and the necessary Agricultural Assistants, Mukaddams, etc., for field and laboratory work. Details are given in Statement No. 2.

In addition to the foregoing, provision has to be made for the purchase and upkeep of cattle, the payment of water rates, seed, etc., and the purchase and maintenance of implements.

The land on which the experiments will be carried out is Government land valued at Rs. 2,10,000. No charge will be made by Government for the use of this land for the purpose of the investigation.

The total cost of the scheme, according to the estimates, amounts to :—

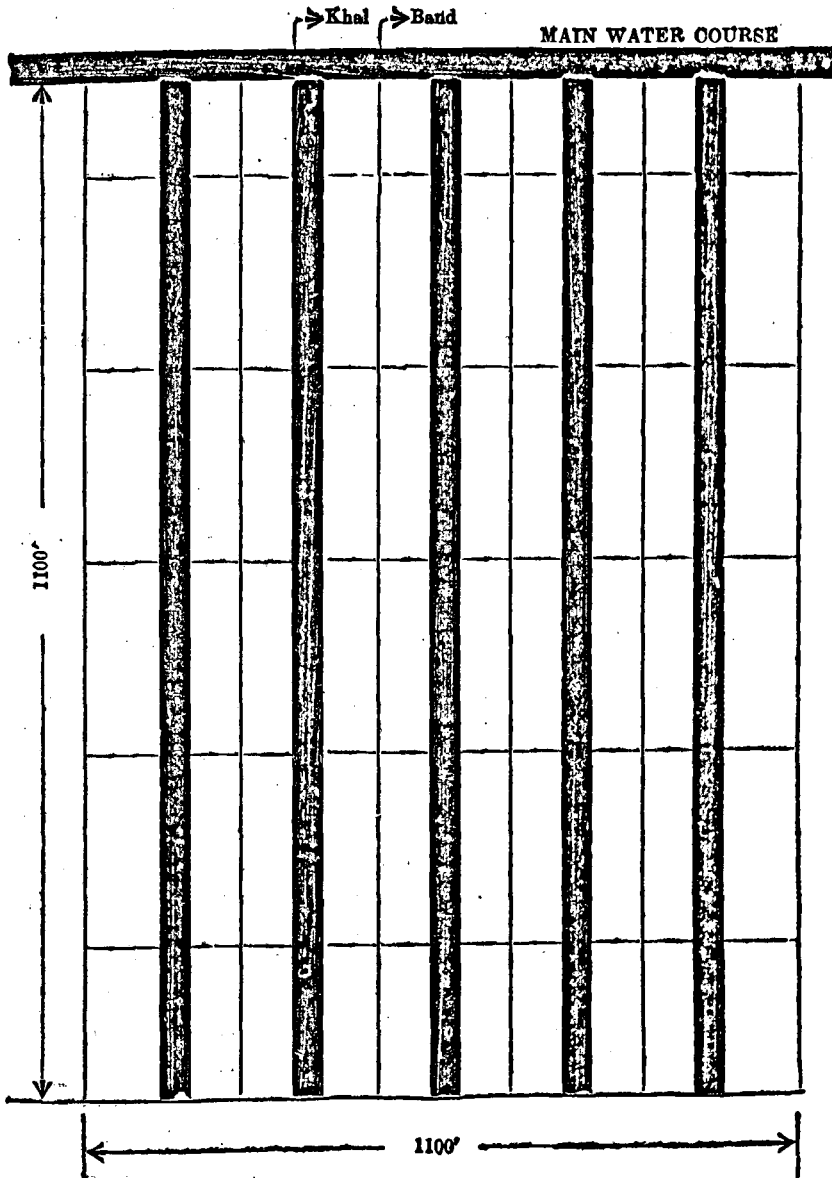
	Rs.
Non-recurring	2,05,000
Recurring (spread over a period of five years)	3,45,000
<b>Total</b>	<b>5,50,000</b>

PROPOSED LAYOUT FOR A SQUARE OF LAND

AT

THE AGRITULTURAL RESEARCH STATION

RISALEWALA.



## STATEMENT NO. 1.

Showing estimated cost of layout of one square of land for the Agricultural Research Station at Bisalewala.

	Rs.	
<b>I. Layout of land per square.—(a) Levelling the old water courses at Rs. 7 per acre .. .. .</b>	195	
<b>(b) Excavation of new water-courses—</b>		
	C. feet.	
Main Khal—1,100' × 4½' × 2½' × ½ .. .. .	6,188	
5 Khals—1,100' × 3½' × 1½' × 5 .. .. .	28,875	
	35,063	
or 35,000 c. ft. at Rs. 7 per 1,000 c. ft. .. .. .	245	
<b>II. Construction of pucca water-courses.—</b>		
(a) Main Khal 1,100'	} 6,050' at Rs. 2-4-0 per foot.	13,612
2		
5 Khals 5,500'		
(b) Iron outlets, 400 at Rs. 12-8-0 each .. .. .	5,000	
(c) Measuring weirs, 5 at Rs. 80 each .. .. .	400	
(d) Level recorders, one for two squares at Rs. 1,000 each	500	
	19,952	
Total cost for 8 squares—Rs. 19,952 × 8 = .. .. .	1,59,616	
Add (1) Cost of branch main channel from the distributary to the farm (about 400 yards) .. .. .	1,000	
(2) Culverts .. .. .	1,800	
	1,62,416	
Total cost .. .. .	1,62,416	
LICAR	2 T	

## STATEMENT NO. 2.

Showing detail of staff required for the Agricultural Research Station at Risalewala.

	Rs.	Rs.
<i>Officer and Officials.</i>		
<i>(a) Agricultural Section—</i>		
1 Extra Assistant Director of Agriculture on Rs. 200—250 25—750 at Rs. 250 per mensem ..	3,000	
4 Agricultural Assistants of at least 3 years' standing on Rs. 100—10—200 10—300 at Rs. 150 per mensem .. .. .	7,200	
1 Statistical Assistant at Rs. 170—20—250 per mensem	2,520	
8 Mukaddams on Rs. 17—1—21 per mensem ..	1,824	
1 Storekeeper on Rs. 34—2—42 per mensem ..	456	
1 Clerk on Rs. 34—2—42 per mensem .. ..	456	
1 Mistri on Rs. 34—1—38 per mensem .. ..	432	
1 Peon on Rs. 14 per mensem .. .. .	168	
36 Beldars at Rs. 17 per mensem each .. ..	7,344	
2 Chaukidars at Rs. 14 per mensem each .. ..	336	
2 Sweepers at Rs. 13 per mensem each .. ..	312	
Variable labour .. .. .	1,700	
		<u>25,743</u>
<i>(b) Engineering Section—</i>		
1 Assistant Engineer on Rs. 450—50—650 per mensem	6,600	
1 Overseer on Rs. 68—7—96 per mensem .. ..	984	
2 Sub-Overseers on Rs. 51—5—71 per mensem each ..	1,464	
4 Khalasis on Rs. 14 per mensem each .. ..	672	
1 Peon on Rs. 14 per mensem .. .. .	168	
		<u>9,888</u>
<i>(c) Soil Physics Section—</i>		
1 Soil Physicist on Rs. 306—40—466 per mensem ..	4,632	
2 Agricultural Assistants on Rs. 85—10—125 per mensem each .. .. .	2,520	
1 Laboratory Attendant on Rs. 17—1—21 per mensem	228	
1 Peon on Rs. 14 per mensem .. .. .	168	
		<u>7,548</u>
<i>(d) Physiological Section—</i>		
1 Plant Physiologist on Rs. 306—40—466 per mensem	4,632	
2 Agricultural Assistants on Rs. 85—10—125 per mensem each .. .. .	2,520	
1 Laboratory Attendant on Rs. 17—1—21 per mensem	228	
1 Peon on Rs. 14 per mensem .. .. .	168	
		<u>7,548</u>
<i>(e) Travelling Allowance .. .. .</i>		<u>3,750</u>
<b>Total recurring ..</b>		<u><u>54,482</u></u>



## STATEMENT NO. 3.

*Showing details of buildings required for the Agricultural Research Station at Risalewala.*

*Buildings.*—The katcha mud huts at present occupied by tenants will be utilised to accommodate mukaddams, beldars, implements and cattle. They will require repairs and alterations before they can be used for the purposes of the scheme.

Some members of the subordinate Agricultural and Engineering staffs, who will be required to live on the site, will be accommodated in buildings already existing on the farm.

The Extra Assistant Director of Agriculture will live in the Farm Rest House.

All other staff will find their own accommodation in the town of Lyallpur.

The following expenditure on buildings is unavoidable :—

	Rs.
Repairs to existing katcha huts .. .. .	4,000
Erection of one store, 30' X 20', with pucca platform outside	1,675
Erection of office room .. .. .	2,000
Erection of field laboratory .. .. .	4,000
	<hr/>
Total non-recurring ..	11,675

## STATEMENT NO. 4.

*Showing the implements required for the Agricultural Research Station at Risalewala.*

	Rs.
(a) Provision of ploughs, harrows, reaper, winnower, cane crushers, hand tools, etc., for cultivation, gauges for the Engineering Section, and meteorological equipment ..	9,880
(b) Office furniture, stationery, etc. .. .. .	2,000
	<hr/>
Total non-recurring ..	11,880

## STATEMENT NO. 5

*Summary showing financial aspects of the Agricultural Research Station at Risalewala.*

	Recurring.	Non-recurring.
	Rs.	Rs.
1. Land .. .. .	Government land	
2. Layout of land and construction of khals ..	1,000	1,62,416
3. Establishment .. .. .	50,732	..
4. Travelling allowance of establishment ..	3,750	..
5. Buildings .. .. .	2,000	11,675
6. Implements .. .. .	1,000	9,880
7. Furniture, stationery, etc. .. .. .	200	2,000
8. Other charges and contingencies .. .. .	600	..
9. Water rate, seed and manure .. .. .	3,000	..
10. Laboratory equipment .. .. .	3,000	10,000
11. Purchase and upkeep of cattle .. .. .	3,700	9,000
	68,982	2,04,971
or say .. .. .	69,000	2,05,000
Total non-recurring as above .. .. .		Rs. 2,05,000
Total recurring Rs. 69,000 × 5 .. .. .		Rs. 3,45,000
Total cost of scheme for 5 years .. .. .		Rs. 5,50,000

## ENCLOSURE II.

*Report of the Committee to consider the establishment of an Agricultural Station at Risalewala (near Lyallpur) for work on the water requirements of crops.*

The following were present :—

1. Mr. T. M. Bostock, Chief Engineer, P. W. D. Irrigation Branch, Punjab, representing the Central Board of Irrigation.
2. Professor N. N. Gangulee.
3. Rao Bahadur D. Ananda Rao,  
Dy. Director of Agriculture, Madras.
4. Mr. T. F. Main,  
Director of Agriculture, Bombay.
5. Mr. D. Milne,  
Director of Agriculture, Punjab.
6. Mr. F. J. Plymen,  
Director of Agriculture, Central Provinces.

7. Mr. Nizamuddin Hyder,  
Director of Agriculture, Hyderabad.
8. Mr. V. A. Tamhane,  
Soil Physicist, Sakrand.
9. Mr. Miller-Brownlie,  
Agricultural Engineer to the Government of Punjab (Visitor).

Mr. Plymen took the Chair.

Mr. Milne explained the revised scheme (Enclosure I) pointing out how it differed from the one submitted before (not printed). He proceeded to explain the proposed layout of the area to be used for experiments. Dr. Gangulee enquired what would be the total number of plots under the scheme. Mr. Milne stated in reply that the exact number of plots would be determined at a later stage in consultation with the Irrigation Engineers but they would be several hundreds in each season.

He explained the need of pucca channels. The wooden flumes as suggested by Dr. Keen would not work under the conditions obtaining in the Punjab. Mr. Main and Mr. Tamhane raised the question of minor distribution methods to be adopted. For *intensive* work, he thought that the minor distribution channels should be pucca. Mr. Bostock suggested that careful levelling of the entire plot would be necessary. Mr. Milne proceeded to explain the outline of investigations to be undertaken.

Referring to Dr. Keen's note (not printed), Mr. Milne said that Widstoe of U. S. A. proceeded on the lines proposed by the Punjab scheme.

Dr. Gangulee asked Mr. Milne whether he would be prepared to reduce the experimental area which is 200 acres. At the initial stage, the work might be proceeded on a modest basis.

Mr. Main and Mr. Tamhane thought that the area was too big for the staff provided for in the scheme.

After discussion it was proposed (1) to reduce the acreage to 4 squares (approximately 100 acres) for intensive investigations as laid out in the scheme; (2) that the Government of the Punjab should be asked to reserve the balance (i.e., 200 acres) of the whole area for the extension of the work as experience suggests and for demonstration as explained below; and (3) that the value of the Farm produce should be credited to the Imperial Council of Agricultural Research. The Punjab Government will also contribute the part time services of the present staff and laboratory facilities at the Lyallpur Agricultural Research Institute. As regards the buildings, the rest house at Risalewala and such *katcha* buildings as are now standing on the site would be made available to the scheme.

It is to be understood that the balance of area of 200, or 150 acres as the case may be, will be managed as a demonstration farm, under *zemindari* conditions, making use of the discoveries made on the intensive experimental area, adopting them to village conditions.

In view of these modifications it has been found possible to effect a substantial reduction in the net cost of the scheme to the Imperial Council of Agricultural Research. The revised estimates are shown in the attached statement from which it will be seen that the Council is asked to provide a sum of Rs. 4 lakhs (approximately) spread over a period of five years.

## Statement of expenditure as now revised by the Committee.

## Non-recurring.

	Rs.
Layout of land .. .. .	82,600
Building .. .. .	11,675
Implements .. .. .	9,880
Furniture .. .. .	2,000
Laboratory equipment .. .. .	10,000
Cattle, etc. .. .. .	9,000
Total .. .. .	<u>1,25,155</u>

## Recurring.

Layout .. .. .	1,000
Establishment. (Statistical Assistant. He is not to be appointed till the need for him is shown) .. .. .	48,212
Travelling .. .. .	2,500
Building .. .. .	2,000
Implements .. .. .	1,000
Furniture .. .. .	200
Other charges, etc. .. .. .	600
Water rate .. .. .	3,000
Laboratory equipment .. .. .	3,000
Purchase .. .. .	3,700
Total .. .. .	<u>65,212</u> × 5
Total .. .. .	<u>3,26,060</u>
Non-recurring .. .. .	1,25,155
Recurring .. .. .	3,26,060
Total cost of scheme for 5 years .. .. .	<u>4,51,215</u>

Receipts @ 9,000 per year = 9,000 × 5 45,000.

	Rs.
Net cost .. .. .	4,51,215
	<u>45,000</u>
	<u>4,06,215</u>

## APPENDIX XXXII.

SUBJECT No. 26.

## REPORT OF THE FRUITS SUB-COMMITTEE.

Attention is invited to the attached note (Enclosure), circulated to the Fruits Sub-Committee, which is self-explanatory. The proceedings of the Sub-Committee will be found in Annexure XV to Enclosure.

The recommendations of the Committee are now for the consideration of the Advisory Board.

M. S. A. HYDARI,

*Secretary.**The 28th January 1932.*

## ENCLOSURE.

## PROVINCIAL SCHEMES OF FRUIT RESEARCH :

- (a) MADRAS.—(Annexures I & II).
- (b) BOMBAY.—(Annexures III & IV).
- (c) BENGAL.—(Annexures V & VI).
- (d) UNITED PROVINCES.—(Annexure VII).
- (e) PUNJAB.—(Annexures VIII & IX).
- (f) ASSAM.—(Annexure X).

At its meeting held in January 1931 the Advisory Board decided that a fruit committee should be constituted to sift schemes of fruit research and to make proposals; that this Committee should examine the Madras scheme first and that the scheme if approved by the Committee with or without amendment should be submitted direct to the Governing Body without its being brought before the Advisory Board as would be done in the case of the other schemes. It was also agreed that full advantage should be taken of such assistance as the Imperial Bureau of Fruit Production at East Malling could render.

2. The Chairman has appointed the undermentioned Committee for this purpose :—

- (1) Diwan Bahadur Sir T. Vijayaraghavacharya, *Chairman (Ex-officio)*.
  - (2) Mr. B. C. Burt, Agricultural Expert, Imperial Council of Agricultural Research.
  - (3) Director of Agriculture, Madras.
  - (4) Director of Agriculture, Bombay.
  - (5) Director of Agriculture, Bengal.
  - (6) Director of Agriculture, United Provinces.
  - (7) Director of Agriculture, Central Provinces.
  - (8) Director of Agriculture, Assam.
- Mr. M. S. A. Hydari, *Secretary (Ex-officio)*.

3. The Committee was to have met at the time of the June 1931 meeting of the Advisory Board ; it could not however meet for want of time. The Committee will now meet on an afternoon which will be fixed later to meet the convenience of members between the 25th and 27th January 1932.

4. The relevant provincial schemes will be found in Annexures I—X. An extract from the Proceedings of the January 1931 meeting of the Advisory Board of the Imperial Council of Agricultural Research (Annexure XI) and a copy of the correspondence which passed between Maulvi Mohd. Shafee Daoodi, M.L.A., and the Imperial Council on the subject of Research in Fruit Production (Annexures XII—XIV) are also enclosed.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

*The 6th January 1932.*

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#### ANNEXURE I.

COPY OF A LETTER FROM S. V. RAMAMURTY, Esq., I.C.S., SECRETARY TO THE GOVERNMENT OF MADRAS, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, DELHI, No. 3273-III|30-1, DATED FORT ST. GEORGE, THE 5TH NOVEMBER 1930.

In continuation of my letter (not printed) No. 356-III|30-3, dated the 6th May 1930, asking for a grant of Rs. 71,200 for research in fruit growing in this Province, I am directed to state that the Director of Agriculture of this Province has since submitted proposals for the establishment of two research stations, one on the plains and the other on the Nilgiris. A statement (as finally revised by the Madras Government and received by the Imperial Council in December 1931) showing the approximate expenditure that will have to be incurred on the station during the next five years is appended (Annexure II).

As stated in my last letter referred to above the scheme is of all-India importance and will be of use to other Provinces also. Owing to the present financial conditions, this Government is not in a position to provide for any recurring or non-recurring expenditure and so I am directed to inquire whether the Council will provide for the whole expenditure and, if not, what portion the Council will be willing to provide.

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#### ANNEXURE II.

##### *Fruit Research Station—Plains.*

Since the War the fruit-growing industry has developed rapidly and the consumption of the better class of fruit which hitherto has been confined to a comparatively small section of the public, is now extending to all classes. During the past 10 years there has also been a considerable increase in export by rail to Bombay, the Nizam's Dominions, Bengal and Central and Northern India. Prior to the present disturbances in Burma, a market for mangoes from the East Coast was being developed. During the season we receive large quantities of oranges from the Central Provinces which has increased since the orange borers (*Chloridolem alcmene* and *C. cinctum*) made their appearance in epidemic form in Mysore and Coorg. The Madras City market also receives oranges, lemons and grape fruit from South Africa and Palestine.

The geographical situation of this Province in relation to other parts of India provides favourable conditions of many kinds of fruit and a recognition of the natural resources is one reason for a very large increase in planting in recent years. In the case of the mango, extension has been practically confined to hitherto uncultivated dry land, whereas the plantain cultivation has developed as a wet land crop and which is grown in rotation with paddy under some of the major irrigation works. As a result of education and increasing interest that is being taken in the improvement of diet, the upper classes are eating a larger quantity of fruit, especially oranges, and in the Kistna district during the past 7 or 8 years in spite of the growing of an inferior variety, the area under this fruit has risen from a few hundred acres to between 4,000 and 5,000. In the Godavari and Vizagapatam districts there is also an increasing demand for citrus plants and the fruit is sold in the middle of the season at a price which does not vary much from that at which oranges are bought in Europe. This fruit compared with many others is of high food value and there is no doubt that women and children in this country would benefit greatly in health by an increase in consumption of citrus which would result by increased production.

In some of the Southern States of America, in the Malaya States and in parts of South Africa increasing attention is being paid to the cultivation of tropical fruit, especially the mango and with the recent development of a market in Europe which is now possible as a result of improvement in cold storage and air service, there is every prospect of an increasingly large overseas market which is being anticipated in Florida by research and plantings of superior varieties on a larger scale than hitherto. Natural resources in Southern India offer an opportunity of competing in the European market, provided the industry is developed now.

The local producer of mangoes has to contend with a number of difficulties. Firstly, it is impossible to buy plants true to type and it is not uncommon in ordering specified varieties to be supplied with miscellaneous and inferior kinds to the extent of 5 to 10 per cent. or more which in the case of some cannot be discovered until the trees begin to bear. This state of affairs immediately lowers the value of a garden but an improvement may be looked for as a result of the elimination of inferior varieties and the raising of the standard of the nurseryman's trade which would result by research. Further, there is no uniformity of practice in the selection of stock and there is wide and promising field of research into the influence of the stock on uniformity of bearing, yield and quantity of fruit. Local methods of propagation are unsatisfactory and are such that desirable types cannot be produced in sufficient quantities to meet the demand which is one reason why nurserymen give such unsatisfactory service to the public. Seedling propagation is resorted to by many people owing to in-arching as practised in some places causing early deterioration of the trees. Seedling propagation results in the production of fruit varying in period of maturity, keeping quality, size and taste, which, if continued, will definitely exclude fruit from the overseas European market. In addition to an investigation of other methods of propagation suitable for local conditions, there is special need for the growing of superior varieties suitable for export because even at the present time in the export trade to Central and Northern India, local dealers on the East Coast state that not more than 50 per cent. of the fruit reaches the consumer. There are other difficulties such as irregular bearing which is gradually being overcome elsewhere by suitable treatment, but concerning which little is known under our conditions. The period over which the crop is marketed in Southern

India is about two months only and it is of particular importance to investigate the possibility of extension. Without progress in this direction there can be no development of a canning industry.

In the case of citrus, a number of similar problems require investigation and at the present time an inferior sour orange is being planted in some places in the Circars, where the Batavian could be grown. The latter, however, when grown on highly deltaic land as a seedling is liable to disease and lack of knowledge regarding the most suitable stock for different conditions is one of the main causes of loss.

Plantain is one of the few crops that can be grown successfully in rotation with swamp paddy and its development is a means by which there can be a large increase in nutritious and uncontaminated food which must become cheaper as the area is extended and for which there will be a growing demand in this and other Provinces as soon as market conditions become more normal. In view of the fall in the price of paddy which unlike many other kinds of produce has been in progress during the past 7 or 8 years and increasing world production including that in Burma at low costs, it is particularly necessary to relieve the situation in this Presidency where the area planted to rice is out of proportion to other crops.

There are a number of difficulties confronting the ryot in the growing of plantain including lack of knowledge regarding the selection of planting material, irrigation, manurial and cultural treatment. For example, in some parts of the Circars it is customary to use on heavy soil naturally retentive of moisture about 40" to 45" more water than on some of the light sandy areas of Ganjam district. Larger quantities of water are often used than is necessary and experiments are necessary to work out requirements. In some places loss is caused by strong winds and the growing of dwarf plantains or improvement in irrigation practice may solve the problem. Varieties suitable for the growing of leaf and the best treatment in contrast to fruit production are matters concerning which there is little information at the present time. Elsewhere disease is causing loss which may perhaps be prevented by the cultivation of disease-resistant varieties.

Other varieties of fruit on which miscellaneous work will be done mainly with the object of improving the fruit in quality and yield will include (i) Sapota, (ii) Guava, (iii) Pineapple and (iv) Cashew-nut.

The main scheme will include the following :—

#### A—MANGO.

- (i) Identification and Classification of local varieties.
- (ii) Selection of types.
- (iii) The propagation of imported varieties with a view to comparing their yield, duration and quality of fruit with the best of the local varieties.
- (iv) Trial of different species of *Mangifera* as stock.
- (v) Propagation—A study of the embryogeny of the mango.
- (vi) Different methods of propagation including budding.
- (vii) Problems of tillage, irrigation, manurial practice, weather, and shade.



## B—CITRUS.

- (i) Classification of local varieties.
- (ii) Selection of types.
- (iii) Methods of propagation.
- (iv) Trial of stock for different soil conditions with special reference to disease-resistance. The effect of the stock on yield and quality of fruit.
- (v) Problems of irrigation, tillage, manuring and weathering.

## C—PLANTAIN.

- (i) Identification and Classification of local varieties.
- (ii) Selection of planting material.
- (iii) Problems of tillage, irrigation, and manurial treatment with reference to yield and quality of fruit.

## D—SAFODILLA.

- (i) Classification of local varieties.
- (ii) Selection.
- (iii), (iv) and (v) As for citrus mentioned.

## E—GENERAL.

Work common to the fruit referred to above will include control of insect pests, the keeping quality of fruit and its marketing.

## FRUIT RESEARCH STATION—PLAINS.

## A.—NON-RECREING—I YEAR.

## Capital Outlay—

	Rs.
1. Land—30 acres at Rs. 800 each including 15 per cent. compensation .. .. .	24,000
2. Buildings—	
(i) Office and store .. .. .	2,500
(ii) Implement and cart shed .. .. .	656
(iii) Cattle sheds (for 2 pairs) .. .. .	500
(iv) Farm Manager's quarters .. .. .	3,500
(v) Store-clerk's quarters .. .. .	1,200
(vi) Potting and grafting shed .. .. .	900
(vii) Shed for oil engine .. .. .	1,000
(viii) Coolies' sheds .. .. .	600
3. Livestock—	
Two pairs of cattle at Rs. 300 per pair .. .. .	600
4. Dead stock—	
(i) Pump and soil engine .. .. .	1,200
(ii) Pipe masonry channels and laying of the land for irrigation .. .. .	1,000
(iii) Fencing .. .. .	3,000
(iv) Implements and tools, etc. .. .. .	600
Total .. .. .	41,256

## B.—RECURRING—I YEAR.

	Rs.
<b>1. Pay of Establishment—</b>	
1 Superintendent at Rs. 250 × 12 (250—25—350)	.. 3,000
1 Farm Manager, Rs. 100 × 12 (100—5—120)	.. 1,200
1 Botanical Assistant, Rs. 95 × 12 (95—5—115)	.. 1,140
1 Clerk, Rs. 35 × 12 (25, 35—1½—50)	.. 420
1 Peon, Rs. 12 × 12 .. .. .	.. 144
1 Fieldman, Rs. 35 × 12 (35—1½—50)	.. 420
2. Allowances—Travelling allowance for staff for carrying out fruit survey .. .. .	.. 1,000
3. Working Expenses .. .. .	.. 3,000
4. Contingencies .. .. .	.. 1,000
5. Purchase of plants and miscellaneous .. .. .	.. 300
<b>Total</b> .. .. .	<b>11,624</b>
<b>Total non-recurring and recurring</b> .. .. .	
	<b>52,880</b>

## II YEAR.

	Rs.
<b>1. Pay of Establishment—</b>	
1 Superintendent, Rs. 275 × 12 .. .. .	.. 3,300
1 Farm Manager, Rs. 105 × 12 .. .. .	.. 1,260
1 Botanical Assistant, Rs. 100 × 12 (100—5—115)	.. 1,200
1 Clerk, Rs. 35 × 12 .. .. .	.. 420
1 Peon, Rs. 12 × 12 .. .. .	.. 144
1 Fieldman, Rs. 36½ × 12 .. .. .	.. 438
2. Allowances—Travelling .. .. .	.. 750
3. Working Expenses .. .. .	.. 3,000
4. Contingencies .. .. .	.. 1,000
5. Purchase of plants .. .. .	.. 308
<b>Total</b> .. .. .	<b>11,820</b>

## III YEAR.

	Rs.
<b>1. Pay of Establishment—</b>	
1 Superintendent, Rs. 300 × 12 .. .. .	3,600
1 Farm Manager, Rs. 110 × 12 .. .. .	1,320
1 Botanical Assistant, Rs. 105 × 12 .. .. .	1,260
1 Clerk, Rs. 36½ × 12 .. .. .	438
1 Peon, Rs. 12 × 12 .. .. .	144
1 Field-man, Rs. 38 × 12 .. .. .	456
<b>2. Allowances—Travelling allowance .. .. .</b>	<b>750</b>
<b>3. Working Expenses .. .. .</b>	<b>3,000</b>
<b>4. Contingencies .. .. .</b>	<b>1,000</b>
<b>5. Purchase of plants .. .. .</b>	<b>302</b>
<b>6. Dead stock—</b>	
Purchase of another pump and oil engine .. .. .	1,200
<b>Total ..</b>	<b>13,470</b>

## IV YEAR.

<b>1. Pay of Establishment—</b>	
1 Superintendent, Rs. 325 × 12 .. .. .	3,900
1 Farm Manager, Rs. 115 × 12 .. .. .	1,380
1 Botanical Assistant, Rs. 110 × 12 .. .. .	1,320
1 Clerk, Rs. 38 × 12 .. .. .	456
1 Peon, Rs. 12 × 12 .. .. .	144
1 Fieldman, Rs. 39½ × 12 .. .. .	474
<b>2. Allowances—Travelling allowance .. .. .</b>	<b>500</b>
<b>3. Working Expenses .. .. .</b>	<b>3,000</b>
<b>4. Contingencies .. .. .</b>	<b>1,000</b>
<b>5. Purchase of plants, etc. .. .. .</b>	<b>326</b>
<b>Total ..</b>	<b>12,500</b>

## V YEAR.

<b>1. Pay of Establishment—</b>	
1 Superintendent, Rs. 350 × 12 .. .. .	4,200
1 Farm Manager, Rs. 120 × 12 .. .. .	1,440
1 Botanical Assistant, Rs. 115 × 12 .. .. .	1,380
1 Clerk, Rs. 39½ × 12 .. .. .	474
1 Peon, Rs. 12 × 12 .. .. .	144
1 Fieldman, Rs. 41 × 12 .. .. .	492
<b>2. Allowances—Travelling allowance .. .. .</b>	<b>500</b>
<b>3. Working Expenses .. .. .</b>	<b>3,000</b>
<b>4. Contingencies .. .. .</b>	<b>1,000</b>
<b>5. Purchase of plants, etc. .. .. .</b>	<b>300</b>
<b>Total ..</b>	<b>12,930</b>

## ABSTRACT.

	Capital Outlay.	Pay of Establish- ment.	Allow- ances.	Working Expenses.	Contingencies.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1st year ..	41,256	6,324	1,000	3,000	1,300	52,880
2nd year ..	..	6,762	750	3,000	1,308	11,820
3rd year ..	1,200	7,218	750	3,000	1,302	13,470
4th year ..	..	7,674	500	3,000	1,328	12,500
5th year ..	..	8,130	500	3,000	1,300	12,930
Total ..	42,456	36,108	3,500	15,000	6,536	1,03,600

## FRUIT RESEARCH STATION--HILLS.

## I YEAR.

	Rs.	Rs.	Rs.
		Recurring.	Non-recurring.
<i>Pay of Establishment--</i>			
1 Upper Subordinate, Rs. 85—5—120, average pay ..	107		
1 Fieldman, Rs. 35—50 .. .. ..	44		
1 Clerk, Rs. 35—60 .. .. ..	48		
1 Peon, Rs. 12—18 .. .. ..	15½		
	<u>214½</u>		
		2,574 or	
		<u>2,600</u>	
<i>Contingencies--Miscellaneous--</i>			
Furniture, postage stamps, etc. .. ..	500	500	
<i>Allowances--Voted--</i>			
<i>Other compensatory (hill allowance)--</i>			
1 Upper Subordinate .. .. ..	25		
1 Fieldman .. .. ..	10		
1 Clerk .. .. ..	10		
1 Peon .. .. ..	2		
	<u>47</u>		
		600	
<i>Capital Outlay--</i>			
<i>Cost of land--</i>			
20 acres at Rs. 200 an acre .. ..	4,000		
Clearing 5 acres .. .. ..	1,000		
Purchasing fruit trees .. .. ..	1,500		
Pitting and planting the above .. ..	500		
	<u>7,000</u>		
			7,000
<i>Nursery--</i>			
Clearing 1 acre .. .. ..	200		
Terracing and revetting .. .. ..	300		
	<u>500</u>		
			500

I YEAR—*contd.*

Buildings—				Recurring. Non-recurring.	
				Rs.	Rs.
Quarters for Upper Subordinate .. ..	..	..	..	3,000	
Quarters for fieldman .. ..	..	..	..	2,500	
Quarters for clerk .. ..	..	..	..	2,500	
Rest-house .. ..	..	..	..	5,000	
Office, tool and fruit store .. ..	..	..	..	3,500	
Drains, revetments, etc. .. ..	..	..	..	1,000	
Fencing .. ..	..	..	..	3,000	
				<hr/>	
				20,500	20,500
Purchase of deadstock (tools and implements) .. ..	..	..	..	..	500
Working Expenses—					
Manures and chemicals .. ..	..	..	..	1,000	
Cooly labour and sundries .. ..	..	..	..	1,000	
				<hr/>	
				2,000	..
				<hr/>	
Total I year .. ..	..	..	..	5,700	28,500
					<hr/>
				34,200	

## II YEAR.

Pay of Establishment .. ..	..	..	..	2,600	2,600	..
Contingencies—Miscellaneous .. ..	..	..	..	200	200	..
Allowances—Voted—Other compensatory .. ..	..	..	..	600	600	..
Capital Outlay—						
Cost of land—						
Clearing 5 acres of land .. ..	..	..	..	1,000		
Constructing drains, revetments .. ..	..	..	..	1,000		
Purchase of fruit trees from Australia .. ..	..	..	..	1,500		
Pitting and planting .. ..	..	..	..	500		
				<hr/>		
				4,000	..	4,000
Purchase of deadstock—						
Tools and implements .. ..	..	..	..	200	..	200
Working Expenses—						
Manures and chemicals .. ..	..	..	..	1,000		
Cooly labour and sundries .. ..	..	..	..	2,600		
				<hr/>		
				3,600		
				<hr/>		
Total II year .. ..	..	..	..	7,000	4,200	
					<hr/>	
				11,200		

## III YEAR.

Pay of Establishment .. ..	..	..	..	..	2,600	..
Contingencies .. ..	..	..	..	..	100	..
Allowances .. ..	..	..	..	..	600	..
Capital Outlay—						
Cost of land (opening and planting 5 acres) .. ..	..	..	..	..	..	5,000
Purchase of dead stock—						
Tools and implements .. ..	..	..	..	..	..	150
Working Expenses—						
Cooly labour and sundries .. ..	..	..	..	..	3,600	..
					<hr/>	
					6,900	5,150
					<hr/>	
Total III year .. ..	..	..	..	..	12,050	

## IV YEAR.

						Recurring,	Non-
					Rs.	Rs.	recurring.
					Rs.	Rs.	Rs.
Pay of Establishment	..	..	..	..	..	2,600	..
Contingencies	..	..	..	..	..	100	..
Allowances	..	..	..	..	..	600	..
Capital Outlay—							
Cost of deadstock—							
Tools and implements	..	..	..	..	100	..	100
Working Expenses—							
Cooly labour and sundries	..	..	..	..	4,000	4,000	..
Total IV year	..	..	..	..	..	7,300	100
						7,400	

## V YEAR.

Pay of Establishment	..	..	..	..	..	2,600	..
Contingencies	..	..	..	..	..	50	..
Allowances	..	..	..	..	..	600	..
Capital Outlay—							
Purchase of deadstock—							
Tools and implements	..	..	..	..	100	..	100
Working Expenses—							
Cooly labour and sundries	..	..	..	..	4,000	4,000	..
Total V year	..	..	..	..	..	7,250	100
						7,350	

## ABSTRACT.

	Pay of Establish- ment.	Contingen- cies.	Allow- ances.	Capital Outlay.	Working Expenses.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
I year	2,600	500	600	28,500	2,000	34,200
II year	2,600	200	600	4,200	3,600	11,200
III year	2,600	100	600	5,150	3,600	12,050
IV year	2,600	100	600	100	4,000	7,400
V year	2,600	50	600	100	4,000	7,350
						72,200

## ANNEXURE III.

LETTER FROM THE DIRECTOR OF AGRICULTURE, BOMBAY PRESIDENCY, POONA, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 123-16067 OF 1931, DATED THE 5TH DECEMBER 1931.

I have the honour to enclose a copy of a letter No. M-1230|52, dated 6th November 1931 (Annexure IV) received from the Empire Marketing Board to the address of Dr. Cheema, Horticulturist to the Government of Bombay.

It is estimated that the expenditure involved will amount to Rs. 4,000 and against this there will be some receipts, but I am unable to estimate these.

I should be glad to know whether the Imperial Council of Agricultural Research desires to take any action in the direction indicated. This Scheme could be regarded as integral of or supplementary to the Cold Storage Research Scheme now under preparation.

## ANNEXURE IV.

COPY OF LETTER FROM THE EMPIRE MARKETING BOARD, 2, QUEEN ANNE'S GATE BUILDINGS, LONDON, S. W. 1, TO DR. CHEEMA, No. M-1230|52, DATED THE 6TH NOVEMBER 1931.

Since you left London I have had a telephone message from the P. and O., who state that, subject to the approval of their Bombay Branch, they are prepared to furnish cold storage space for experimental shipments of mangoes next season at £3-5-0 per ton of 40 cubic feet. This seems a very reasonable rate, and if it is agreed on, there appears to be every prospect of small shipments being commercially successful.

The Board will be glad to co-operate in any experimental consignments which you are able to arrange, but I would emphasise that for the maximum information to be derived from the experiment, a series of shipments should be forwarded on the lines we discussed. It is impossible to test the market for a new commodity unless regular supplies are available over a fairly long period, as buyers are rarely interested in a line which cannot be repeated. Further, a single shipment affords little opportunity of investigating the optimum stage of maturity for export.

I would therefore suggest that you forward 10 successive weekly shipments, each of 10 trays, over the period from the middle of April till the end of June. The shipping temperature employed last season (40-45° F.) appears to have been successful and should be retained. The bulk of the consignments would presumably be Alphonso mangoes packing about 12 fruits to a tray, but I think it would also be of advantage to include in each shipment about 20 or 30 trays of a less expensive variety with smaller fruits packing up to 24 to the tray, to test the possibilities of the cheaper trade. The name of the variety and number of fruits contained should of course be marked on each tray.

I would also suggest that the mangoes should be consigned in the first place to the Secretary of the Empire Marketing Board. We should then be able to undertake a detailed examination of the fruit, retain samples under

observation, and hand over the bulk of the consignment to suitable firms for marketing. Reports on each consignment could be sent you as they arrived, while a detailed report on the whole series would be drawn up at the end of the experiment.

I am enclosing a letter (not received) which arrived soon after you left London giving particulars of German railway rates.

#### ANNEXURE V.

##### *Proposal for the appointment of a Horticultural Officer in Bengal.*

For several years the Bengal Agricultural Department has been endeavouring to develop fruit culture in the Darjeeling district. Owing to shortage of funds this work has necessarily been limited but even so, the results obtained have indicated that fruit culture in the district has a promising future. Varieties of oranges and pineapples introduced have not only been taken up by local cultivators, but are to be found in the neighbouring States of Sikkim and Bhutan. The cultivation of peaches and plums is extending whilst a pear, one of many introduced, is bearing high class fruit.

It is now proposed that a Horticultural Officer be appointed to determine the kinds and varieties suited to the Eastern Himalayas, and to investigate problems of shoot and root pruning, manuring, propagation, etc.

Land and office accommodation is available on the Kalimpong Farm.

It is proposed that the pay of officer should be Rs. 250—20—330 per mensem with a Field Assistant on Rs. 50—2|8—60 per mensem. There will be no initial expenditure.

The recurring cost will be—

	First year.	Second year.	Third year.	Fourth year.	Fifth year.
	Rs.	Rs.	Rs.	Rs.	Rs.
Horticultural Officer ..	3,000	3,240	3,480	3,720	3,960
Field Assistant .. ..	600	630	660	690	720
Peon .. .. .	180	180	180	180	180
Chemicals and apparatus ..	100	100	100	100	100
Seeds, manures and implements	2,500	2,500	2,500	2,500	2,500
Labour .. .. .	720	720	720	720	720
Travelling allowance ..	1,000	1,000	1,000	1,000	1,000
	8,100	8,370	8,640	8,910	9,180
	Rs. 43,200.				

ROBERT S. FINLOW,

RAMNA (DACCA),

The 16th April 1931.



## ANNEXURE VI

*Proposal for the establishment of a Horticultural Station on the plains of Bengal.*

The Royal Commission on Agriculture emphasised the great importance of research on fruit in India because fruit, whether grown on an orchard basis or as a subsidiary crop, is a potential source of revenue to the cultivator.

A scheme for the establishment of a Horticultural Station on the plains of Bengal was submitted to and approved by the Government of Bengal as long ago as 1922, but owing to lack of funds it has never been possible to commence work.

The districts of Malda, Murshidabad and Nadia are famous for mangoes and litchis. There are numbers of varieties, some with local reputation whilst others are known all over India. It is desirable not only to examine these varieties with a view to determining their value from the point of view of palatability and yield but to experiment on methods of culture including cultivation, pruning and propagation.

Apart from mangoes and litchis, there is great scope for the introduction of improved types of guavas, custard apples, mangosteens, citrus fruits, etc. Owing to financial stringency the Government of Bengal is unable to allot funds for the development of fruit culture and it is hoped that the scheme may be subsidised by the Imperial Council.

It is proposed that the station be in charge of an officer on Rs. 250—20—330 per mensem with a Field Assistant on Rs. 50—28—60 per mensem and a clerk on Rs. 30 per mensem. Provision is also made for peons and malis.

Land will be provided by the Government of Bengal at Krishnagar in the district of Nadia. The Government of Bengal is not, however, at present in a position to provide other capital expenditure. The Horticultural Officer and clerk can reside in the town of Krishnagar, but the Field Assistant must be resident on the station. Quarters must also be provided on the station for malis and coolies.

The estimated cost will be—

			Rs.
<i>Non-recurring.</i>			
Laying out and fencing	..	..	5,000
Field laboratory and office	..	..	5,000
Quarters for Field Assistant	..	..	3,000
Quarters for malis, peons and coolies	..	..	2,400
Bullock shed	..	..	1,000
Pottery shed	..	..	250
Bullocks, six pairs	..	..	1,500
Implements and apparatus	..	..	1,000
			19,150

*Recurring.*

	First year.	Second year.	Third year.	Fourth year.	Fifth year.
	Rs.	Rs.	Rs.	Rs.	Rs.
Horticultural Officer ..	3,000	3,240	3,480	3,720	3,960
Field Assistant .. ..	600	630	660	690	720
Clerk .. .. .	360	360	360	360	360
<b>House-rent—</b>					
Horticultural Officer ..	300	300	300	300	300
Clerk .. .. .	60	60	60	60	60
2 Peons .. .. .	312	312	312	312	312
4 Malis .. .. .	720	720	720	720	720
Labour .. .. .	960	960	960	960	960
Feed of cattle .. .. .	1,500	1,500	1,500	1,500	1,500
Contingencies .. .. .	1,000	1,000	1,000	1,000	1,000
Travelling allowance ..	1,000	1,000	1,000	1,000	1,000
	9,812	10,082	10,352	10,622	10,892
	Rs. 51,760.				

ROBERT S. FINLOW.

RAMNA (DACCA),  
The 16th April 1931.

## ANNEXURE VII.

*An application from the Government of the United Provinces to the Imperial Council of Agricultural Research for a grant of Rs. 3,91,410 (Rs. 83,200 non-recurring and Rs. 3,08,210 recurring) spread over five years for researches into the development of fruit industry both in the hills and the plains of the United Provinces. (Supported in general outlines by the United Provinces Agricultural Research Committee in resolution No. 4 passed at their 5th meeting held on November 23, 1931.)*

The scheme is divided into two parts :—

(1) Hills and (2) Plains.

## I.—THE FRUIT INDUSTRY OF KUMAUN HILLS.

## INTRODUCTION.

The fruit industry of Kumaun dates back to about 1870 when the Government orchard at Ghoubattia was started. Following this a number of other orchards were started by private enterprise in various parts of Kumaun. Subsequently interest appears to have died down and many of the existing orchards deteriorated badly. In more recent years the industry has shown fresh life more or less coincident with the taking over of the Government orchard by the Department of Land Records and Agriculture in 1915. The difficulty of getting fruit to railroad undoubtedly militated against successful fruit growing specially in small orchards.

With the coming of cheap and quick motor transport this difficulty has been greatly reduced, and at the present time some of the large orchards are being extended and many small orchards are being started.

Although started so long ago it is only comparatively recently that real development has begun to take place. The industry is still in its infancy, and it is at this time that research work will be of most value in developing it along right lines. Much useful work has already been done at Chaubattia but much remains to be done if the industry is to be firmly established on a sound footing.

India presents a vast and at present almost untouched market for hill fruits. Already Australia, South Africa and the United States are making efforts to capture this market. There appears to be no reason why the Indian demand should not be met entirely by fruits grown in the hill tracts of India itself, and in such a development Kumau should play a large part.

#### SUITABILITY OF THE GOVERNMENT ORCHARD AT CHAUBATTIA FOR A RESEARCH STATION.

To study effectively the various problems connected with fruit growing in the hills it is necessary to have both old and young orchards. The renovation of old orchards cannot be studied except in an old orchard. Insect pests and fungus diseases are more prevalent in an old orchard than in a young one, in fact some kinds may be entirely absent in a young orchard. A young orchard is desirable to test various cultural methods, and additional land is necessary for the introduction and trial of new varieties, stock trials and other special experiments it may be desired to carry out. Further, it is very essential that the orchard should be Government-owned so that the officers carrying out research work can have full control, a state of affairs which cannot be expected in a privately-owned orchard.

The Government orchard at Chaubattia fulfils all these conditions. It is Government-owned, there is both old and new orchard, and there is forest land included in the property which can be cleared for any necessary extensions. In addition, this orchard already possesses a very large collection of all varieties of hill fruits. It also possesses a number of buildings and although some alterations and additions will be necessary the cost will be trifling compared to that required for the erection of new buildings. It is accessible, a motor road passing within five minutes' walk of the office and main buildings of the orchard.

From the point of view of an all-India research station Chaubattia appears to be the most suitable location. All the above-mentioned advantages are applicable in this case also. The existing collection of varieties is probably the largest in India and in addition the orchard is situated in the largest hill fruit growing district in India.

#### BRIEF HISTORY OF THE GOVERNMENT ORCHARD.

The orchard was started in 1869-70 by the Forest Department which were fortunate in obtaining the services of a trained gardener, Mr. Craw, who was resident in the district, to look after it and he continued in charge until his death 21 years later. From the commencement the garden was used for the propagation of both fruit and forest trees. Good varieties of fruit trees were obtained from Europe, propagated and planted out in the orchard. When trees began to bear fruit the result was so successful that the local Government laid down that "the chief object in view in the upkeep of this garden was the free distribution of the finer varieties of such fruit trees as would thrive in the climate and soil of the outer ranges of the Himalayas, to show practically the best methods of culture for

the various species and to prove what could be done in the culture of excellent fruit under proper treatment."

During the 21 years that Mr. Craw remained in charge 125,000 fruit trees and 250,000 forest trees were grown and distributed free to all who asked for them. The result of this distribution, especially among villagers, has been disappointing.

The death of Mr. Craw proved a great loss to the orchard which subsequently passed through a period of administrative uncertainty. In 1892 an attempt was made to lease the orchard but this was not successful for want of a suitable offer. In 1893 the Forest Department suggested, and Government agreed, that the orchard should continue to be maintained by the department but that a catalogue should be drawn up and fair prices charged for young trees offered for sale. This policy was subsequently followed except for an unsuccessful attempt in 1896 to sell the orchard as a going concern for Rs. 20,000.

The foregoing information is culled from a report on the orchard in 1906 by W. H. Lovegrove, Deputy Director of Forests.

The Government orchard continued to be maintained in more or less poor condition till 1914 when, under G. O. No. 2544|I—321, dated October 16, 1914, it was handed over to the Director of Land Records and Agriculture, Mr. Gill, who was then Superintendent of the Kumaon Government Gardens, was placed in charge and continued to hold charge till 1923, since when several garden superintendents have been in charge. In 1925 the orchard was leased for a period of seven years.

#### DESCRIPTION OF THE GOVERNMENT ORCHARD.

The Government orchard is situated on the Ranikhet-Chaubattia hill between the elevation of 6,100 feet and 6,700 feet and is about 2½ miles distant from Ranikhet by forest path and about five miles by motor road. It is about 5¼ miles by motor road from railhead (Kathgodam). The general aspect of the orchard is north, which is the best for fruit growing. The soil is mostly a fairly stiff clay, though considerable variations occur. It is generally sufficient in depth. The slopes vary but are in most cases not very steep. A few springs are present but are scarcely sufficient to supply the staff and the nurseries. The rainfall is about 60 inches. The shade temperature varies from about 23° in winter to about 80° in summer. During April and May hailstorms are not infrequent and often cause considerable damage to the fruit crops. The area of the orchard is 142 acres which includes 50 acres of old orchard, portions of which have in recent years been planted with young trees, about 30 acres of new orchard, all the trees in which are young, and about 62 acres of forest.

According to the orchard records the number of trees in bearing is 4,698 while the number of young trees which have not yet come into bearing is 5,359. The average annual yield of all kinds of fruit for the past 15 years is 59,000 lb.

The old orchard would appear to have been planted in small blocks of one variety each but subsequent planting to repair casualties was of a haphazard nature with the result that varieties are very scattered and there are more trees of a culinary type than is desirable. Recent planting both in the old and new orchards has been in lines or small blocks.

The collection of varieties at the present time includes about 190 which were in the orchard when it was taken over in 1915, about 125 imported by Mr. Gill up to 1922, about 100 imported by me in 1923-24 and about 20 imported since.

The Chaubattia orchards carry capital assets valued at Rs. 68,970 and a sum of Rs. 6,010 was spent annually on their maintenance by the United Provinces Government before they were leased out.

## SUGGESTED PROBLEMS FOR THIS RESEARCH STATION.

(1) *Renovation or rejuvenation of old orchards.*—

(2) *Prevention of young orchards becoming worn out, or at least lengthening the productive life of orchards.*—The problem of renovation is an urgent one in the case of old orchards and in course of time will become urgent for all other orchards unless some method can be discovered under which the productive life of an orchard can be more or less indefinitely prolonged. The application of manure in sufficient quantity is, of course, an obvious remedy, but for most of the orchards manure is not obtainable in sufficient quantity and with an extension of the fruit growing industry sufficient quantity will be still less obtainable. Another obvious remedy is to abandon the old orchard and start a new one, but this will be beyond the financial capability of most fruit growers and, in any case, with the extension of the fruit industry, suitable land within reasonable distance of railhead will become more and more difficult to obtain. If, therefore, the fruit industry is to be placed on a firm footing the solving of these problems is a necessity.

(3) *Catch crops to make young orchards pay before the fruit trees come into full bearing.*—One of the main difficulties to be faced in starting an orchard is the fact that except for the first two or three years when good crops of potatoes can be grown there is little or no income from the orchard for some years, while maintenance charges have to be met and the owner and his family have got to live. The solving of this difficulty would do much to popularize fruit growing especially among men of small capital.

(4) *Introduction of new varieties for trial.*—This is very important to the well-being of the fruit industry as the average small orchard owner cannot afford to import new varieties on the chance that one or more of them may prove to be desirable acquisitions. The Government orchard has already done a lot of work in this direction and possesses what is probably by far the best and most representative collection of hill fruit trees in India. New varieties, however, continue to be evolved in Europe, America and Australia, and it is in the interest of the fruit industry that these varieties should be introduced and tested under Kumaun conditions and those that prove worth while propagated and distributed.

(5) *Keeping properties of fruit.*

(6) *Shipping qualities of fruit.*—These two problems are somewhat related to the former (No. 4).

The most important crop grown is the apple, in many orchards forming more than half of the total crop of all kinds of fruit. The bulk of the apple crop ripens in September and October and if it were all placed on the market then there would be a glut and prices would be so low that marketing the fruit would result in loss to the growers rather than profit. Fortunately some varieties of apples have good keeping properties and under suitable conditions may be kept till March or April. From trials already carried out it would appear that the reputation of varieties for keeping properties in other countries is not a sure guide for Kumaun. Investigations to ascertain the best varieties for keeping and for how long it is safe to keep each variety will be of great value to fruit growers.

The foregoing experiment might also include some research into the best methods of storage and also a cheap form of storage room.

The shipping qualities of fruit, by which is meant the ability of fruit to travel long distance and arrive at its destination in good condition, is another important

point. Good size, colour, flavour and heavy cropping propensity in a variety are not of much value unless combined with good shipping qualities, as without the latter sales must be confined to local markets which, for most orchards, are small or non-existent. Investigation into this problem will, therefore, be of great benefit to the fruit industry as it will enable advice to be given which will prevent the planting of apparently attractive varieties which will be of little market value.

(7) *Crop records*.—The fruiting propensities of the different varieties is a very important question in the planting of orchards. There is, of course, some general knowledge on the subject but definite knowledge is lacking. After eliminating varieties known to be unsuitable for marketing for one reason or another, a collection of the other varieties, three trees of each, might be planted and records of the crops from each tree for a period of years maintained, and if possible some record also of the prices obtained for the fruit. Such records, combined with those of keeping and shipping properties, will enable the Government orchard staff to give most valuable and reliable advice to fruit growers, regarding the most paying varieties to grow.

(8) *Stocks*.—This is very important phase of fruit growing in the hills about which very little is known. Most of the budded or grafted fruit trees at present being grown in Kumaun are on some form or other of imported paradise stock or on locally raised mixed seedling stock. Two or three years ago, the Deputy Director of Gardens imported some varieties of apple, plum and cherry stock from East Malling. These are now being experimented with but it is desirable that the experiment should be carried out on a much larger scale. Much information of great value to the fruit industry may result from stock experiments, as for instance, better cropping properties, greater resistance to dry conditions during the hot weather, greater immunity to Woolly aphid attack.

(9) *Grading, packing and marketing of fruit*.—Under modern conditions no fruit which is not properly graded and packed can command good prices in the open market. In India so far as hill fruits are concerned this is becoming more and more important with the increasing imports from South Africa, Australia and the United States. A few of the more up-to-date orchardists in Kumaun are alive to the importance of good grading and packing but the majority are not. During the years immediately previous to the leasing of the Government orchard grading and packing received due attention but since the orchard was leased these operations have been done in a slipshod manner. Grading and packing are carried out on well defined principles in Europe and America and it should not be difficult to evolve a system on similar lines which will be suitable to Indian conditions. When a suitable system has been worked out short instructional classes could be given, free of charge, to all interested in the fruit industry who cared to attend. Some years later it might be possible to enact a law, as has been done in some parts of the United States, making it compulsory for all fruits to be properly graded and packed.

Closely related to the questions of grading and packing is that of marketing. To dispose of fruit to the best advantage involves considerable knowledge of the requirements of the various markets. Much could doubtless be done in this direction in collaboration with the marketing officers who have been or will be appointed. A simple system of accounts in connection with marketing might also be worked out.

(10) *Best kinds of fruit for various soils*.—Under the conditions obtaining in the hills the nature of the soil is liable to vary considerably and except in the case

of very small orchards, no orchard is likely to have soil of the same quality throughout its area. It is therefore important to be able to advise fruit growers what are the best kinds of trees to plant in the various kinds of soil in their orchards. Experiments along these lines will, therefore, be of value.

(11) *Cultural problems.*—Among these may be mentioned pruning, ringing, manuring, mulching, propagation of stocks, etc.

Pruning is a much debated subject and there are many systems in vogue. What is required is to ascertain which system or combination of systems is best suited to Kumaun conditions. This will, of course, vary with each kind of fruit.

Ringing is a method adopted to bring young trees into bearing more quickly than they would otherwise do. Very little is known about it in Kumaun.

Manuring experiments would be worth while to ascertain the best combinations and most economical quantities, and the best times for applying them, for each of the different kinds of fruit trees.

Mulching appears to be likely to be a useful cultural practice but little is known about it at present.

To obtain reliable stocks vegetative propagation is necessary. Very little of this has been done in Kumaun and experimental work is necessary to find out the best methods.

(12) *Profitable utilization of surplus and inferior fruit.*—There is always likely to be some fruit which, owing to gluts in the market or to inferior quality, it is difficult to dispose of profitably. The obvious methods of dealing with such fruit are by canning, preserving and evaporating. Owing to the scattered locations of orchards and their distance from railhead, it is doubtful if canning and preserving are likely solutions of the problem. They and other methods, are, however, worth investigations.

(13) *Insect pests.*—Insect pests are responsible for heavy losses in orchards in all parts of the world and Kumaun and other hill districts are not exceptions to this rule. Among the commoner ones may be mentioned Woolly aphid, borers, caterpillars and beetles. To ascertain the most effective methods of control it is necessary to study the life histories of the insects and this requires frequent observation throughout the year. This is, doubtless, the reason why so little research work in connection with the hill orchard pests has been carried out in India, no trained entomologist having been stationed in the hills until the recent appointment of one at Ramgarh. Although the research work of other countries is available and is of assistance in controlling pests in this country, it is not sufficient. In some cases the pests may be different but even where they are the same the conditions vary and other methods of control may be found cheaper or more effective.

(14) *Fungus diseases.*—While not nearly so numerous as insect pests there are several fungus diseases which cause much damage in hill orchards.

The immediate problems in this connection are :—

- (1) Cankers.
- (2) Root rots.
- (3) Silver leaf disease.

- (4) Leaf curls.
- (5) Blights.
- (6) Storage rots, etc., etc.

The Plant Pathologist to the Government suggests a thorough survey of the prevailing diseases and the life histories of the casual organisms and to work out control measures.

(15) *Chemical aspects.*—According to Mr. H. N. Bathum, the Agricultural Chemist to Government, the work of the chemist in connection with the hill orchard research may be divided into four heads :—

- (1) *Soil.*—The terraced soils of the hills are very varied in nature. A thorough chemical and mechanical examination of soils and sub-soils will be essential for successful cultivation of fruit trees.
- (2) *Manures and fertilizers.*—Analysis of these will also be necessary before their application.
- (3) *Trees.*—The growth of trees, their bearing capacities and their resistance power of diseases seem to have a marked relation with the type of soil on which they are grown. All this needs a thorough investigation.
- (4) *Fruits.*—The flavour, colour and keeping qualities of the fruit are very important commercially. These qualities are governed by the presence of certain definite chemical compounds in the fruits. Chemical analysis of fruits at different stages of growth, ripening and storage will thus form a necessary item of chemical investigations.

A soil chemist is an essential part of any scheme of lasting nature for carrying on necessary preliminary work of soil analysis. Correlation of chemical data with soil conditions suitable to particular fruits is the only way to obtain information of permanent value upon which future development of the industry can safely depend.

**Details of the cost of the proposed " Fruit research scheme," Kumauu.**

**HORTICULTURAL REQUIREMENTS.**

*Non-recurring.*

	Ra.
Terracing .. .. .	6,000
Fruit storage room .. .. .	1,000
Alteration to buildings .. .. .	900
Equipments .. .. .	850
Miscellaneous (including importing of stocks) .. .. .	1,250
	<hr/>
Total, Non-recurring	10,000
	<hr/>



## Recurring (spread over five years).

Particulars.	First year.	Second year.	Third year.	Fourth year.	Fifth year.	Total five years.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
<i>Salaries.</i>						
One horticulturist at Rs. 1,000—50—1,500.	12,000	12,600	13,200	13,800	14,400	66,000
One assistant horticulturist at Rs. 250—25—750.	3,000	3,300	3,600	3,900	4,200	18,000
Total, Salaries ..	15,000	15,900	16,800	17,700	18,600	84,000
<i>Pay of establishment.</i>						
One clerk at Rs. 75—5—100 ..	900	960	1,020	1,080	1,140	5,100
Two males—one at Rs. 50—2—60 & other at Rs. 20—1—25.	840	876	912	948	984	4,560
One laboratory assistant at Rs. 25—2½—40.	300	330	360	390	420	1,800
Two peons at Rs. 15 each.. ..	360	360	360	360	360	1,800
Total, Pay of establishment ..	2,400	2,526	2,652	2,778	2,904	13,260
<i>Allowances.</i>						
Travelling allowance of the horticulturist and his staff.	2,000	2,000	2,000	2,000	2,000	10,000
Total, Allowances ..	2,000	2,000	2,000	2,000	2,000	10,000
<i>Supplies and Services.</i>						
Maintenance of the hill orchard ..	8,000	8,000	8,000	8,000	8,000	40,000
Experiments such as crop records, trial of stocks, manurial and other experiments.	2,000	2,000	2,000	2,000	2,000	10,000
Books and periodicals .. ..	100	100	100	100	100	500
Total, Supplies and Services ..	10,100	10,100	10,100	10,100	10,100	50,500
<i>Contingencies.</i>						
Miscellaneous office contingencies ..	500	500	500	500	500	2,500
Total, Contingencies ..	500	500	500	500	500	2,500
Total, Recurring .. ..	..	..	..	..	..	1,60,260
Total, Recurring and Non-recurring ..	..	..	..	..	..	1,70,260

## Entomological, mycological and chemical requirements.

*Non-recurring.*

Alteration to buildings and fittings for the three laboratories at Rs. 1,500 each.	Rs. 4,500
Equipment of the three laboratories at Rs. 3,500 each ..	10,500
Hot house for inoculation experiments (mycological) ..	1,000
<b>Total, Non-recurring ..</b>	<b>16,000</b>

*Recurring (spread over five years).*

Particulars.	First year.	Second year.	Third year.	Fourth year.	Fifth year.	Total five years.
<i>Salaries.</i>						
One entomologist at Rs. 250—25—750.	Rs. 3,000	Rs. 3,300	Rs. 3,600	Rs. 3,900	Rs. 4,200	Rs. 18,000
One mycologist at Rs. 250—25—750	3,000	3,300	3,600	3,900	4,200	18,000
One chemist at Rs. 250—25—750 ..	3,000	3,300	3,600	3,900	4,200	18,000
<b>Total, Salaries ..</b>	<b>9,000</b>	<b>9,900</b>	<b>10,800</b>	<b>11,700</b>	<b>12,800</b>	<b>54,000</b>
<i>Pay of establishment.</i>						
One store-keeper and record-keeper at Rs. 75—5—100.	900	900	1,020	1,080	1,140	5,100
Three laboratory assistants at Rs. 25 2½—40.	900	900	1,080	1,170	1,260	5,400
Three laboratory attendants at Rs. 16—1—20.	576	612	648	684	720	3,240
Three peons at Rs. 15 each ..	540	540	540	540	540	2,700
<b>Total, Pay of establishment ..</b>	<b>2,916</b>	<b>3,102</b>	<b>3,288</b>	<b>3,474</b>	<b>3,660</b>	<b>16,440</b>
<i>Allowances.</i>						
Travelling allowance of entomologist, mycologist, chemist and their staff at Rs. 1,000.	3,000	3,000	3,000	3,000	3,000	15,000
<b>Total, Allowances ..</b>	<b>3,000</b>	<b>3,000</b>	<b>3,000</b>	<b>3,000</b>	<b>3,000</b>	<b>15,000</b>
<i>Supplies and Services.</i>						
Laboratory equipment—chemicals & apparatus at Rs. 500 for each la- boratory.	1,500	1,500	1,500	1,500	1,500	7,500
Freight, etc., at Rs. 20 each labora- tory.	60	60	60	60	60	300
Books and periodicals at Rs. 100 each	300	300	300	300	300	1,500
Field works at Rs. 250 each ..	750	750	750	750	750	3,750
Sundry at Rs. 100 each ..	300	300	300	300	300	1,500
<b>Total, Supplies and Services ..</b>	<b>2,910</b>	<b>2,910</b>	<b>2,910</b>	<b>2,910</b>	<b>2,910</b>	<b>14,560</b>
<b>Total, Recurring ..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>99,990</b>
<b>Total, Recurring and Non-recurring ..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>1,15,990</b>
<b>Total cost of the scheme ..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>2,86,250</b>

N. B.—The land and the buildings are provided by the United Provinces Government, and thus no expenses on that account have been asked for. The amount demanded is required for the development of the work already being carried out on a small scale. Taking into account of the hilly nature of the tract, where everything is difficult to manage, the costs are not much.

## II.—Scheme for the improvement and extension of fruit culture on the plains of the United Provinces.

There are large areas in the plains of the United Provinces where both the soil and climate are suitable for the cultivation of a wide variety of fruits. A fair quantity of fruits is already grown, especially in such centres as Saharanpur and Lucknow. The extension of this industry is very desirable. Advice on cultural questions with visits to private orchards free of charge is being carried out by the staff of the garden circle and this will no doubt be of great assistance to fruit growers. There are, however, many problems connected with fruit growing which it is necessary should be solved if the best is to be got out of the land planted with fruit trees and the growing of fruit thus made more popular. To carry out the necessary experimental work effectively a large area will have to be devoted to this purpose in which the main object will be the solving of problems connected with fruit growing and not with making revenue, though some revenue will naturally be obtained.

### EXPERIMENTAL WORK.

*Mangoes.*—To plant out a collection including varieties from all parts of India. If varieties which are known to be decidedly inferior are excluded the collection may perhaps be limited to about 250 varieties. Three plants of each variety are essential, five of each would be preferable. Such collection will be of great value in several ways :—

- (1) To eliminate some of the confusion in mango nomenclature by enabling accurate, detailed descriptions of the varieties to be prepared. Owing to the variation in shape and colour of mango fruits, even on the same tree, it is necessary to select average fruits for detailed descriptions and, also to state what variations from this are likely to occur. This can only be done if the whole crop of a tree can be examined.
- (2) To maintain records of the flowering periods of each variety in relation to cropping properties.
- (3) To maintain records of the ripening periods of each variety.
- (4) To maintain records of the keeping properties and shipping qualities of each variety.
- (5) To maintain records of the crops of each variety to ascertain the best varieties for commercial purposes.
- (6) To enable hybridization work to be carried out for the production of improved varieties.

If only three trees each of 250 varieties are obtained and these are planted at 50 feet apart an area of 42 acres will be required. If five trees of each variety are planted about 70 acres will be required.

*Citrus.*—A collection of oranges (malta and *santara*), limes, pomelos and grapefruits, including varieties already in the Government gardens and others which may be imported, to be planted to ascertain which are the varieties most suited for commercial purposes. Records would, of course, have to be kept of the crops.

One hundred and twenty varieties, five trees of each, planted at 20 feet apart will require about 5½ acres.

A trial of orange stock to ascertain the best stock for malta, *santaras* and grapefruits (1) for cropping and (2) for longevity.

If 15 stocks are tried with five trees each for three types of citrus there will be 225 trees. At 20 feet apart these will require a little over 2 acres.

Citrus will therefore require about 8 acres.

*Ber*.—*Ber* is a fruit which has been much neglected. A collection to ascertain the best varieties for size, flavour and cropping properties will be well worthwhile. It might also be possible to ascertain if the fruits of any varieties are immune to maggot attack.

Forty varieties, five trees of each, 25 feet apart, will require about 3 acres.

*Peaches*.—A small collection of about 20 varieties, five trees of each, may be planted so that records of crops can be maintained and the best varieties for commercial purposes ascertained.

One hundred trees at 15 feet apart will require about half an acre.

*Plums*.—A small collection of about 20 varieties, five trees of each, may be planted so that records of crops can be maintained and the best varieties for commercial purposes ascertained. One hundred trees at 15 feet apart will require about half an acre.

*Shareefas*.—*Shareefas* are grown from seed and there is little doubt that many of the trees that are sold for planting have been raised from inferior types. A collection of *shareefas* from various parts of India where they are reputed to do well will be worthwhile to enable a selection to be made of those that produce fruits of good quality and have good cropping properties. A really good strain could thus be worked up. Experiments in budding the *shareefas* have just been started.

About 400 trees at 15 feet apart will require about 2 acres.

*Papitas*.—These are also raised from seed. Some good strains are already being grown in various parts of the province. If, however, a really big effort were made to get together a representative collection of all the best strains available, propagation continued each year from selected fruits of the highest quality only, a really fine strain could be developed. Work along these lines is already being done but on a small scale which can never attain the same results.

*Papitas* can be grown in between other fruit trees while the latter are young so no extra land will be required.

*Loquats*.—A collection of these, five trees of each variety, may be planted to ascertain which are the best market varieties. Two acres would probably be sufficient and would allow room for new varieties which may be imported.

*Miscellaneous fruit trees*.—A plot should also be reserved for miscellaneous fruit trees, such as *lechis*, *aonlas*, *jamuns*, bananas, grapes, jackfruits, guavas, persimmons, etc., to ascertain the best varieties for commercial purposes. Even in kinds where there are few varieties, such as *aonla* and *jamun*, an effort to collect good types might quite likely result in the discovery of an improved variety.

A plot of 10 acres in extent would probably be sufficient for these miscellaneous kinds.

*Crop records*.—For all kinds of fruits records should be maintained of the yearly crops of each variety and, if possible, of each tree. Records of average selling prices should also be maintained. These records, together with record of

maintenance costs for each plot, will make it possible to work out with a fair amount of accuracy the probable expenditure and receipts for each kind of fruit crop for each year. This is information which every prospective fruit grower would like to have and which the department should be in a position to give.

*Manurial experiments.*—While a good deal is known about the manuring of fruit trees very little has been done in the way of definite experiments in the United Provinces. Such experiments must, of course, include artificial manures and green manuring. At least 50 trees of each of the more important kinds of fruit trees should be grown solely for manurial experiments and should give valuable results. For this purpose about 10 acres should be sufficient.

*Catch crops.*—These might include other quickly maturing fruit crops such as *papita* and *phalsa*, agricultural and vegetable crops. The long period which elapses between the planting of the more important kinds of fruit trees and the trees coming into full bearing is probably one of the main reasons why fruit growing has not been taken up more largely especially among the landowners of small capital. Any assistance which can be given in this direction will undoubtedly tend to popularize fruit growing.

*Grading and packing.*—Practically no grading is done at present. Packing methods are unsatisfactory. In the Saharanpur district, and possibly in other districts, boxes, usually kerosine oil boxes, are gradually replacing baskets, and although somewhat crude, represent a definite advance. Much, however, remains to be done. Suitable containers for each kind of fruit must be worked out. For the home market good grading and packing will result in better prices as they have done for temperate fruits in other parts of the world. If the United Provinces is to obtain a share in the export trade of mangoes, which now seems certain to develop, good grading and packing will be absolute essentials.

*Insect pests and fungus diseases.*—As a result of research work at Pusa, Cawnpore and elsewhere much is known about insect pests and fungus diseases. In a large young orchard such as that contemplated much work of a practical nature could no doubt be done to ascertain which methods of control are the best and most economical.

#### LOCATION OF EXPERIMENTAL ORCHARD.

The experimental fruit orchard should be located in a district known to be suitable for fruit growing. There are several good fruit districts in the United Provinces. Of these according to the Deputy Director of Gardens, Saharanpur would be the best. It is already a large fruit growing district, the number of kinds of fruit trees that can be successfully grown is probably large than in other districts, there is a resident superintendent of gardens who could take charge of the experimental orchard, and there is a botanical garden maintained by the United Provinces Government with a capital outlay of Rs. 1,29,117 and an annual expenditure of Rs. 19,500 on its maintenance. It is also the head-quarters of the Deputy Director of Gardens, United Provinces.

In a venture of this kind in which the useful life of the trees will vary according to variety, from 10 to 50 years, it is not desirable to plant them on rented land unless on a lease of at least 50 years. It will be still better for the orchard to be located on Government land, either transferred from some other department or purchased for the purpose. It should be irrigated either by canal or by tube wells. The latter method would be preferable as there would be less trouble from weeds, more accurate records of water required for the trees could be maintained,

and it would demonstrate the possibilities of fruit growing on land not irrigated by canals. The location should be easily accessible to encourage visits from people interested in fruit growing.

#### COST OF PROPOSALS.

##### *Non-recurring.*

*Land.*—About 100 acres will be required. This is more than detailed in the foregoing notes, but some space will be required for roads and buildings, and a little should be left over for additional experiments. I understand that the Punjab Government has allotted 500 acres for fruit trials, etc., at Lyallpur. This estimate of 100 acres is, therefore, comparatively very modest.

The following are rough estimates for purchase of land in the Saharanpur district :—

Purchase Rs. 20,000 for 100 acres, rent Rs. 1,300 for 100 acres.

These figures are liable to considerable modification on account of accessibility of land, irrigation facilities, etc. It would be better to purchase the land, as it would be uneconomical to invest money on improvements on a rented or leased piece.

*Buildings.*—(1) One building comprising a packing shed, store room and office room. Lump sum estimate Rs. 2,000. This building will not be required during the first two or three years. A store room will, of course, be necessary but one of the *mali's* quarters can be used for this purpose until a proper one is built.

(2) One building for head *mali's* quarters

(3) One building for *mali's* quarters.

} Lump sum Rs. 2,000.

*Roads.*—Some *pucca* roads will certainly be desirable to enable manure, etc., to be brought in and fruit to be taken out, and also to enable the visitors to get round the orchard comfortably. Lump sum Rs. 3,000. Roads are not essential at the beginning and may be deferred till more funds are available.

*Fencing.*—This is essential. The length of fencing required will vary according to the shape of the land. Lump sum Rs. 4,000.

*Masonry water channels.*—These are not absolutely essential to begin with but it is certainly desirable to have them to avoid loss of water which always occurs in *katcha* water channels. At a rough estimate 7,000 running feet will be required which, at annas eight per running foot, will cost Rs. 3,500.

*Tube-wells.*—If canal irrigation is not available two or three tube-wells will be required.

*Digging holes for trees.*—Many of these can, of course, be dug by the staff but at the beginning there will be a rush and it is therefore advisable to provide for some holes to be dug by a contract. For this purpose Rs. 300 should be sufficient.

*Manure.*—To ensure good growth it is essential that manure should be mixed with the soil before planting, Rs. 2,500.

*Cost of trees.*—A number of trees can be supplied free by the Government gardens but some will be imported from foreign countries, and others, especially mangoes, from various parts of India. It is difficult to make an estimate, Rs. 3,000 would probably be sufficient.

*Implements.*—These will include a spraying machine, *phawras*, etc., Rs. 500.

*Cattle.*—At least two pairs of bullocks will be required for ploughing work. Lump sum Rs. 400.

Details of the cost of the proposed "Fruit research scheme" for plains at Saharanpur.

*Non-recurring charges.*

	Rs.
Land .. .. .	20,000
Buildings, packing shed, store room and office room ..	2,000
<i>Mali's</i> quarters .. .. .	2,000
Roads .. .. .	3,000
Fencing .. .. .	4,000
Masonry water channels .. .. .	3,500
Two tube-wells .. .. .	16,000
Digging holes for trees .. .. .	300
Manure .. .. .	2,500
Cost of trees .. .. .	3,000
Implements .. .. .	500
Cattle .. .. .	400
<b>Total, Non-recurring</b> .. .. .	<b>57,200</b>

*Recurring charges.*

Particulars.	First year.	Second year.	Third year.	Fourth year.	Fifth year.	Total.
<i>Staff and establishment.</i>	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
One member of Subordinate Agricultural Service (trained in garden circle) on overseer's grade pay Rs. 140—10/2—240.	1,680	1,680	1,800	1,800	1,920	8,880
One head <i>mali</i> on Rs. 30—2—50 ..	360	384	408	432	456	2,040
One assistant to head <i>mali</i> on Rs. 20—1—30.	240	252	264	276	288	1,320
Four <i>malis</i> on Rs. 13 each ..	624	624	624	624	624	3,120
Twenty coolies at Rs. 10-8 each ..	2,520	2,520	2,520	2,520	2,520	12,600
<b>Total, Pay of establishment</b> ..	<b>5,424</b>	<b>5,460</b>	<b>5,616</b>	<b>5,652</b>	<b>5,808</b>	<b>27,960</b>
<i>Contingencies.</i>						
Miscellaneous (including purchase and repair of tools, purchase of manure and cost of water, etc.)	4,000	4,000	4,000	4,000	4,000	20,000
<b>Total, Contingencies</b> ..	<b>4,000</b>	<b>4,000</b>	<b>4,000</b>	<b>4,000</b>	<b>4,000</b>	<b>20,000</b>
<b>Total, Recurring</b> .. .. .	<b>9,424</b>	<b>9,460</b>	<b>9,616</b>	<b>9,652</b>	<b>9,808</b>	<b>47,960</b>
<b>Total, Recurring and Non-recurring</b> .. .. .	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>..</b>	<b>1,05,160</b>

*N.B.*—The garden staff of the Government will be incharge of the work and hence no great demand has been made of the overhead charges. The existing buildings in the Saharanpur garden will be utilized and only a few necessary items required for the working of the new piece have been asked for.

## An abstract of the costs of the complete scheme for hills and plains.

					Non-recurr- ing.	Recurring.	Total.
					Rs.	Rs.	Rs.
Hill scheme	..	..	..	..	26,000	2,60,250	2,86,250
Plains scheme	..	..	..	..	57,200	47,980	1,05,180
Total cost				..	83,200	3,08,210	3,91,410

## ANNEXURE VIII

*Scheme for the grant of Rs. 15,980 from the Imperial Council of Agricultural Research, for experiments on the preservation of fruits and vegetables.*

1. *Fruit preservation indispensable for development of fruit industry.*—Fruit farming and fruit preservation must go hand in hand if the fruit industry is to develop on proper lines. Even in a well-managed garden there is always a considerable percentage of fruit that is unfit for sale in the fresh market either because it is too small, or unshapely, or partly spoiled by insects or fungus, or overripe, or underripe, or is defective in some other way. Sometimes in the case of easily perishable fruit, even if it is good it cannot be sold at a profit merely because of a temporary glut in the market. The present practice is that inferior fruits are either auctioned in the market mixed with good fruits or are allowed to go to waste. Fruit farming can be profitable, and make continued progress only if first class fruits are placed on the market (both local and outside markets) and inferior fruits are utilized for various by-products in a way that will fetch an economic return to the grower.

2. *Surplus fruit in the Punjab.*—In the Punjab at present a large amount of fruit goes to waste. In mango-growing tracts of the districts of Hoshiarpur, Gurdaspur, etc., the fruit in some years does not fetch even Re. 0-8-0 a maund. Thousands of maunds go to waste because it does not pay to pick or cart it. These fruits, although of poor quality, might nevertheless be used for some by-products. Similarly in date-growing tracts, due to untimely rains in many years a good deal of the fruit goes to waste, which might be used for products like vinegar, etc. In the Kulu valley Mr. Lee, a prominent fruit grower, reported that in his garden (covering 17 acres) alone about 1,000 maunds of pears went to waste last year. In the plains it sometimes happens that the entry to the towns, of some kinds of fruits, is prohibited owing to cholera with the result that a large amount of the easily perishable fruit in nearby garden goes to waste.

3. *Import into India.*—There are no separate figures of canned fruit and vegetables imported from abroad, but some idea can be got from the fact that imports into India of fruits and vegetables in the year 1927-28 amounted to Rs. 2,01,93,711 of which dried, salted or preserved fruits alone amounted to Rs. 1,76,86,786. Preserved fruits are at present marketed at a price even beyond the reach of fairly well-to-do Indians. For instance a tin of fruits (peaches,



pears, etc.) and a tin of peas which are retailed in a rich country like the United States of America at Re. 0-8-0 and 0-6-0 each, respectively, are sold here at Rs. 1-8-0 and 1-2-0 each, respectively. These articles, if manufactured locally, can be marketed at a very low price, and in that case the demand for such products will rise very rapidly. The Empire Canning Council has also laid very great emphasis on the necessity of developing this industry. It remarks that in the United States of America there was in 1927 a production of canned foods alone worth over one billion dollars (\$1,000,000,000) while the British Empire capable of producing almost every kind of fruit, and with many times the population of United States of America, can only produce a fraction of what America does.

4. *Products for which there is scope in the Punjab.*—(a) The production of various products such as vinegar, jams, jellies, etc., should be tried from fruits like dates, mangoes, pears and apples, etc., that go to waste at present. There is a crying need for doing something in this direction in Kulu, in the mango localities of Ambala, Hoshiarpur, Jullundur, and Gurdaspur districts, etc.

(b) Orange marmalade, lemon juice, candied orange peels.

(c) Tomato sauce which is relished both by vegetarians and non-vegetarians and which is already being imported in large quantities from abroad. Tomatoes are being grown in various parts of the Punjab almost to perfection. Their production would at once increase if they could be utilized for such products.

(d) Dried fruits and vegetables like apple rings, cauliflowers, peas, etc., (dried by modern scientific methods) especially in hilly places where transportation charges are prohibitive and fuel is very cheap. Dried vegetable and fruits hardly weigh from 5—20 per cent. of their weight in the fresh stage. Apple rings are made in Kulu and vegetables are dried all over the province, but the quality is miserably poor.

(e) *Preservation of peas and gram in the green state.*—Peas and grams can be bought in the market, when in season, at almost one anna a seer, and if grown by the manufacturers they will cost still less.

5. If the proposal is approved of, investigation will be started on the manufacture of products in the order given above. The above work will keep a man busy throughout the year. The scheme is for three years, and the Assistant asked for in appendix A (Annexure IX), would stay for three to four months during the summer in Kulu, and for the rest of the year at Lyallpur. In the Kulu valley he would devote his attention to improving the methods of drying vegetables and fruits (apple rings, etc.), and to the manufacture of products like vinegar, jams, etc. The rest of the work will be done at Lyallpur.

6. *Facilities already available.*—The Punjab Agricultural College has already got a small laboratory with necessary equipment such as can-sealing machines, bottle cappers, cookers, pressure sterilizers, steam jacketed kettles, juice extracting press, slicers, pulper, vinegar generator, etc., etc. A small vertical steam engine for the supply of steam has also been ordered. So there will be no great expenditure for apparatus, etc., for carrying on work at Lyallpur. For work in Kulu, however, a certain amount of extra equipment costing altogether Rs. 1500 will have to be provided. The work will be carried on under the guidance of the Fruit Specialist to Government, Punjab, and the extra staff required will only be one Research Assistant and one Laboratory Attendant.

## ANNEXURE IX.

*Appendix A showing expenditure in connection with the scheme for experiments on the preservation of fruits and vegetables.*

## FIRST YEAR.

*Non-recurring.*

	Rs.
<i>Apparatus</i> .—Such as juice extracting press, barrels, buckets, pans for boiling juice, kettles, tin cans, bottles, glass jars, a small dehydrator, trays, stove, exhaust fan, etc.	1,500

*Recurring—*

One Research Assistant at Rs. 250 per month ..	3,000
One Laboratory Attendant at Rs. 30 per month ..	300
Contingencies such as fruits, extra labour, etc. ..	800
Travelling expenses .. .. .	500

Total recurring ..	4,600
Total non-recurring ..	1,500

Total ..	6,160
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## EXPENDITURE 2ND YEAR.

*Recurring—*

Staff same as 1st year .. .. .	3,360
Contingencies .. .. .	800
Miscellaneous Apparatus .. .. .	250
Travelling expenses .. .. .	500

Total ..	4,910
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## EXPENDITURE 3RD YEAR.

Same as 2nd year .. .. .	4,910
Total for 3 years .. .. .	15,980

## ANNEXURE X.

COPY OF LETTER FROM THE SECRETARY TO THE GOVERNMENT OF ASSAM IN THE TRANSFERRED DEPARTMENTS, AGRICULTURE BRANCH, TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, NEW DELHI, No. 3342-E., DATED SHILLONG, THE 10TH DECEMBER 1930.

I am directed by the Government of Assam to forward a note by the Officiating Director of Agriculture, Assam, outlining a scheme for investigating the

possibilities of fruit culture in this province on an organised basis, and to request that it may be laid before the Advisory Board so that it may be presented to the next session of the Governing Body with this Government's request for financial aid. As the Council are aware, the resources of the province are lamentably insufficient even for work upon the staple crops, and it is impossible to allot more than trivial amounts for the purpose of experiment in promising new fields such as this of fruit culture. The Assam Government, therefore, trust that the Council may find it possible to contribute the whole recurring and non-recurring cost of the venture, especially in view of the natural suitability of the province for expansion of fruit-growing, and also of the fact that the demands made by them upon the Council's resources have been limited by strict scrutiny of the proposals made by their Agricultural Department. The nature and scope of the scheme are fully detailed in the accompanying note.

#### A SCHEME FOR EXPERIMENT ON FRUIT CULTURE IN ASSAM.

1. With the large area covered by hill districts and the varying climatic and soil conditions, the possibilities of fruit growing in Assam are very large. Out of a total provincial area of 35,299,970 acres the hills comprise 13,950,080 acres, of which 11,120,826 acres are reported to be arable and only 909,652 acres are under actual cultivation. A considerable portion of the arable area in the hills could be planted profitably with fruit plants. The importance of Assam for fruits has been stressed in paragraph 515 of the report of the Royal Agricultural Commission. Most of the plains abound in "Tillas" or small hillocks, which though not very suitable for ordinary crops, may be profitably planted with fruit trees. In the plains the cultivation of fruits, wherever possible, is likely to prove a much more paying proposition in Assam, with its labour difficulties, than many of the ordinary crops, particularly for educated farmers. The actual area under fruits, roots and vegetable is, however, reported to be only 545,293 acres, of which perhaps less than half is under fruit.

2. *Citrus fruits.*—The orange is *par excellence* the most important commercial fruit in Assam. Oranges from Assam not only supply the markets of Bengal, including Calcutta, but even find their way up to Akyab in the east, Madras in the south and Benares in the west. The fruit is grown extensively on the slopes of the Khasi Hills and is extending throughout the plains of the whole province—the present acreage being estimated as about 11,000. With proper methods of cultivation, picking and marketing, the Assam orange should find a ready market throughout India, Burma and perhaps even in Europe. Recent figures of export are not available but the figures from 1904-05 to 1921-22 indicate an annual export varying from 29,837 maunds valued at Rs. 2,38,696 to 104,714 mds. valued at Rs. 5,44,514 through Chhatak in Sylhet, through which place most of the oranges of the Khasi and Jaintia Hills pass for export by boat. The export through other channels must be at least another 25 per cent. of this figure. Most of these oranges find their way to Bengal and other provinces, which shows the interest of other provinces in the problem of improvement of the crop. There are various problems in connection with its cultivation which require investigation.

The most serious factor limiting the cultivation of oranges in Assam is the yellowing or "die-back" of the trees, the cause of which requires further investigation. Enquiries show that this is acting as a serious deterrent to the expansion of cultivation. The most important line of investigation, however, will be the trial of suitable stocks for budding. Budding is a simple method for propagating a large number of trees in a short time, and, in the case of

oranges, the budded trees may be expected to come to fruit in three years whereas a seedling would take about seven years or more. This presents an opportunity of getting a hardy root, while budded trees produce more uniform fruits and a better shaped tree than seedlings. Experiments are being made on this line at Haflong and Khanapara (Gauhati) fruit gardens but the work is restricted by limited resources. The areas both at Haflong and Khanapara require enlargement and a much larger number of plants have to be budded than the department has been able to deal with hitherto. Varieties from other provinces should also be tried. The types grown in the different parts of the province vary somewhat in quality. The most promising types should be tested and suitable selections made for different localities.

There is a large demand already for orange seedlings and grafts from within and beyond the province, which cannot be supplied. Properly developed, these two stations will be able to supply all the requirements. Grape fruits are rapidly coming into considerable importance and there are large possibilities of extension in Assam, the soils of which are suitable for most citrus fruits. "Pomellos" are already largely grown. During the last year some budded grape fruit plants were obtained from Florida and planted at Jorhat and Haflong. Some of these have come into fruit this year and a few more plants have been indented for. Budding has also been started. It is, however, necessary to carry out systematic experiments on a more extensive scale.

In paragraph 515 of their report the Royal Commission have mentioned the transport difficulties of fruit growers in Assam. This is indeed a serious difficulty but a preliminary enquiry is necessary so that remedies may be suggested to achieve substantial results. It has not been possible to ascertain the loss caused by present methods of picking, packing and marketing of oranges but this is known to be considerable. Not only is there loss in quantity during transit, but defective methods of picking and packing are undoubtedly responsible for a considerable deterioration in value. Oranges are transported from Assam by country boats, steamers and railways. To enable the growers to get the maximum value it is necessary to make careful enquiries as to the destination of the fruit and the cheapest and quickest methods of transport. A marketing officer has, therefore, been provided in the scheme. He will make enquiries as to how the oranges are sold, their ultimate destination, methods of transport, and loss during transit, and will suggest remedies. It is very probable that action on co-operative lines will considerably reduce the losses, but for such a purpose a special trained officer is needed.

3. *Deciduous Fruits*.—The experiments on the deciduous fruits have been carried out mainly at the La Chaumiere Garden, Shillong, since 1912. It has been shown that certain varieties of apples, pears, peaches and plums can be grown successfully, and grafts have been supplied throughout the province. During the last ten years over 1,500 grafts are reported to have been supplied from the La Chaumiere Garden to various places including Barisal in Bengal and Ranchi.

4. There is now little doubt that with the selection of suitable varieties pears, peaches, plums and certain varieties of apples can be grown in all the Khasi and Jaintia Hills, and fruit-growing can be developed as a very profitable business. It is also clear that in many parts of the hill areas deciduous fruits can be successfully grown but it is now desirable to discover which varieties are most suitable for particular areas. Experiments on a limited scale have been carried out by various persons. These have, however, not been carried out systematically or under scientific control. It is necessary to extend the experiments

and keep accurate records, so that the varieties best suited to each locality may be selected.

The principal experiments to be carried out may be summarised as follows :—

1. Trial of various indigenous stocks for grafting and budding.
2. Trial of different varieties under different conditions.
3. Selection and propagation of a few definite commercial varieties and their extensive distribution.
4. Trial of various manures and fertilisers.

Incidentally experiments will also be conducted on the following lines :—

1. Control of the "woolly aphis" (*aphis lanigera*) as well as of other diseases of deciduous fruits.
2. Trial of various methods of pruning.
3. Commercial management of orchards.
4. Encouragement of private commercial orchards wherever possible especially by supplying suitable grafts.
5. Introduction of better methods of picking, packing and marketing.

5. A good deal of work along each of these lines for deciduous fruits has already been done by the late Mr. C. H. Holder as the lessee of the Government Garden at Shillong. A large number of grafts were obtained from abroad and many of them have been successfully grown. A number of imported and indigenous stocks have been tried, but the experiments have not yet been exhaustive or reduced to scientific form. Assam with its wealth of jungles affords a particularly fruitful field for experiments with indigenous stocks, which require further investigation.

6. It is, therefore, proposed that the experiments on deciduous fruits should be carried out at and from the La Chaumiere Garden and that on citrus fruits at the Khanapara Farm at Gauhati and the Baktiar Farm at Haflong, both of which require extension for the purpose.

7. Details about these stations are given below :—

*La Chaumiere Garden.*—This is believed to be one of the best gardens for deciduous fruits on this side of India. It contains an arable area of 30 acres of which 22.66 acres are under fruit trees. There are now about 6,000 fruit trees in the garden, consisting of 3,171 apples, 775 pears, 362 plums, 321 peaches and the balance of miscellaneous trees mostly in bearing condition. A large number of the trees, however, require replacement and attention. There are also a large number of grafts. The garden was started in 1912, and was under the management of Government until 1921, when it was leased out to the late Mr. Holder, previously the manager, on behalf of Government, who died in August 1930. If the present scheme is accepted all experiments on deciduous fruits will be carried out at this station, which will also form the nursery for supplying grafts of these trees for the whole province and perhaps beyond. With proper

development, it is confidently expected that at least 1,000 grafts can be supplied annually from this station. The station will be under the immediate supervision of a Fruit Inspector.

*Khanapara, Gauhati.*—This station will be used for experiments on citrus fruits and pineapples as outlined above, particularly for the Assam Valley. The present orchard consists of about three acres only and there is no room for expansion except by acquisition of some more land. There is an area of about 5 acres of suitable land contiguous to the present orchard which can be acquired. Budded orange plants will be supplied for the Assam Valley from this station. Five acres should be planted with oranges.

There are at present about 450 orange trees which are expected to come into bearing in 2 or 3 years.

*Baktiar, Haflong.*—This will be the main station for work on oranges and pineapples for the Surma Valley. There are now about 250 orange trees, most of which are in a bearing condition, and over one thousand seedlings. The work on budding oranges has been carried on since 1925, and some of the budded plants have come into bearing this year. This orchard requires expansion, and plenty of contiguous Government land is available. At present an Overseer is in charge but more expert supervision is required and a Fruit Inspector will be stationed here. Five acres should be planted with oranges.

8. *Staff.*—The experimental work will be at any rate for the present, under the supervision of the Economic Botanist, who had special training in fruit culture in California. The whole of his salary and travelling allowance will be borne by the Local Government. Any laboratory work necessary will be conducted at the departmental laboratory at Jorhat by the existing staff. The headquarters of the present Fruit Inspector should be removed to Shillong. He will be in charge of the work in the Khasi and Jaintia Hills and the Assam Valley. No provision for a residential building is necessary as he can easily live in the town. A Second Fruit Inspector should be appointed for the Surma Valley with headquarters at Baktiar. Quarters will have to be provided, as the orchard is about three miles away from the town of Haflong and no private houses are available even in the town. It is impossible for one Fruit Inspector to manage the work of the whole province.

The Fruit Inspectors will not only look after the Government orchards in their respective circles but will also visit private gardens and give advice, for which there is great demand, as an increasingly large number of educated people are taking to fruit growing. They will also arrange for the supply of fruit trees and grafts. Each will require a peon.

*Khanapara, Gauhati.*—This will be in charge of an Horticultural Assistant working under the Fruit Inspector, Shillong. As the headquarters of the Fruit Inspector will be in Shillong, it will be necessary to have a superior type of man in charge than an ordinary overseer.

*Baktiar, Haflong.*—The Fruit Inspector, Surma Valley, will have his headquarters at Haflong and will supervise the work of this station, which will be in immediate charge of an overseer as at present.

A grafter will be required at each of the three stations at Shillong, Gauhati and Haflong. At present there are one Fruit Inspector and one grafter at

Khanapara and one overseer at Haflong. They will continue to be paid by the Department as shown in the detailed estimates.

9. If the scheme is accepted there will be a great incentive to fruit-growing and as the whole of the produce will not be required for consumption within the province, there will be a large surplus for export and canning, in both of which the Empire Marketing Board is interested. The successful working of the scheme will benefit not only this province but consumers of fruits throughout India.

*Cost of Scheme.*—The total cost for a period of five years will be Rs. 78,656 after deduction of the present provincial expenditure, as shown in the abstract.

*Receipts.*—It is rather difficult to form an estimate of probable receipts with any degree of accuracy as there are few data to go upon. It is believed that the present receipts from the sale of fruits from La Chamliere Garden will not be less than between Rs. 2,500 to Rs. 3,500 per annum. The probable receipt from sale of grafts may be estimated at Rs. 500 per annum.

Both at Haflong and Khanapara it is proposed to have about five acres under orange trees. When these come into bearing, the receipts may be estimated at Rs. 2,500 to Rs. 3,500 from each.

If the Council of Agricultural Research provides the extra funds needed the excess receipts over those for the present year will be allowed for on such terms as may be agreed upon between the Council and Government.

B. N. CHAKRAVARTY.

The 25th November 1930.

*Abstract of estimates for fruit culture in Assam.*

Particulars.  1	Non-recurring.	Net recurring for 5 years (after deducting contribution by local Government).					
		1st year. 2	1st year. 3	2nd year. 4	3rd year. 5	4th year. 6	5th year. 7
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1. Fruit Experiment Station at Haflong.	9,200	1,550	1,562	1,574	1,586	1,598	7,870
2. Fruit Experiment Station at Khanapara (Gauhati).	5,000	1,420	1,492	1,564	1,636	1,708	7,820
3. Fruit Experiment Station at Shillong.	5,000	3,910	3,922	3,982	3,994	4,054	19,862
4. Appointment of one Fruit Inspector in the Surma Valley with headquarters at Haflong.	5,300	2,280	2,580	2,700	2,712	2,832	13,104
5. Appointment of one Marketing Enquiry Officer for one year.	..	5,500	..	..	..	..	5,500
Total ..	24,500	14,660	9,556	9,820	9,928	10,192	54,156

*Estimate for the Fruit Experimental Station at Haflong.*

Details.  1	1st year.		2nd year.	3rd year.	4th year.	5th year.	Ultimate annual.
	Non-recurring. 2	Recurring. 3	Recurring. 4	Recurring. 5	Recurring. 6	Recurring. 7	Recurring. 8
<b>ESTABLISHMENT.</b>	Ra.	Ra.	Ra.	Ra.	Ra.	Ra.	Ra.
One Overseer (Ra. 30—4/2—50).	..	360	360	408	408	456	492
One grafter mali (Ra. 25—140).	..	300	312	324	336	348	384
<b>Allowance, etc.—</b>							
Travelling allowance ..	..	50	50	50	50	50	50
Water supply ..	2,000	..	..	..	..	..	..
Reclamation ..	500	..	..	..	..	..	..
Godown ..	2,500	..	..	..	..	..	..
Overseer's quarters ..	1,200	..	..	..	..	..	..
Labourer's shed ..	500	..	..	..	..	..	..
Quarters for grafter mali	1,200	..	..	..	..	..	..
Fencing ..	1,000	..	..	..	..	..	..
Furniture ..	100	..	..	..	..	..	..
Implements ..	200	..	..	..	..	..	..
Seeds, plants and manures	..	400	400	400	400	400	400
Wages of labourers ..	..	1,000	1,000	1,000	1,000	1,000	1,000
<b>Miscellaneous contingencies—</b>							
Stamps, office expenses, etc., including one garden mali.	..	500	500	500	500	500	500
Petty repairs ..	..	300	300	300	300	300	300
<b>Total ..</b>	<b>9,200</b>	<b>2,910</b>	<b>2,922</b>	<b>2,982</b>	<b>2,994</b>	<b>3,054</b>	<b>3,126</b>
<i>Deduct—Expenditure to be met from Provincial grant—One overseer</i>							
Contingencies including menial.	..	360	360	408	408	456	492
<b>Total Deduction ..</b>	<b>..</b>	<b>1,000</b>	<b>1,000</b>	<b>1,000</b>	<b>1,000</b>	<b>1,000</b>	<b>1,000</b>
<b>Net estimate ..</b>	<b>9,200</b>	<b>1,550</b>	<b>1,562</b>	<b>1,574</b>	<b>1,586</b>	<b>1,598</b>	<b>1,634</b>

					Ra.
Net non-recurring ..	..	..	..	..	9,200
Recurring for 5 years ..	..	..	..	..	7,870
<b>Grand Total ..</b>					<b>17,070</b>



*Estimate for Fruit Experimental Station at Khanapara, Gauhati.*

Details.	1st year.		2nd year.	3rd year.	4th year.	5th year.	Ultimate annual.
	Non-recurring. 2	Recurring. 3	Recurring. 4	Recurring. 5	Recurring. 6	Recurring. 7	Recurring. 8
<b>ESTABLISHMENT.</b>	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1 Horticultural Assistant (Rs. 60—8—120).	..	720	792	864	936	1,008	1,128
1 Grafting mali (Rs. 25—1—40).	..	300	312	324	336	348	364
Quarters for Horticultural Assistant.	2,500	..	..	..	..	..	..
Quarters for grafting mali..	1,200	..	..	..	..	..	..
Acquisition of land (5 acres)	500	..	..	..	..	..	..
Reclamation and fencing	500	..	..	..	..	..	..
Implements .. ..	200	..	..	..	..	..	..
Furniture .. ..	100	..	..	..	..	..	..
Seeds, plants and manures	..	200	200	200	200	200	200
Wages of labourers ..	..	600	600	600	600	600	600
Miscellaneous contingencies	..	100	100	100	100	100	100
Petty repairs .. ..	..	100	100	100	100	100	100
<b>Total</b> ..	5,000	2,020	2,104	2,188	2,272	2,356	2,512
<i>Deduct</i> —Expenditure to be met from Provincial grant—1 Grafting mali.	..	300	312	324	336	348	364
Contingencies .. ..	..	300	300	300	300	300	300
<b>Total Deduction</b> ..	..	600	612	624	636	648	684
<b>Net estimate</b> ..	5,000	1,420	1,492	1,564	1,636	1,708	1,828

					Rs.
Total non-recurring	..	..	..	..	5,000
Total recurring for 5 years	..	..	..	..	7,820
				<u>Grand Total</u>	<u>12,820</u>

*Estimate for Fruit Inspector in the Surma Valley with headquarters at Haslong.*

Details.  1	1st year.		2nd year.	3rd year.	4th year.	5th year.	Ultimate annual.
	Non-recurring. 2	Recurring. 3	Recurring. 4	Recurring. 5	Recurring. 6	Recurring. 7	Recurring. 8
<b>ESTABLISHMENT.</b>	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1 Fruit Inspector (Rs. 125—300).	..	1,500	1,800	1,920	1,920	2,040	2,472
1 Peon (Rs. 15—1/3—18—1/5—20).	..	180	180	180	192	192	204
Allowances, etc.—							
Travelling Allowance of establishment.	..	500	500	500	500	500	500
Quarter for 1 Fruit Inspector.	5,000	..	..	..	..	..	..
Quarters for 1 peon ..	300	..	..	..	..	..	..
Contingencies—							
Miscellaneous, stamps etc.	..	100	100	100	100	100	100
<b>Total</b> ..	<b>5,300</b>	<b>2,280</b>	<b>2,580</b>	<b>2,700</b>	<b>2,712</b>	<b>2,832</b>	<b>3,276</b>

					Rs.
Total non-recurring ..	..	..	..	..	5,300
Total recurring for 5 years ..	..	..	..	..	13,104
					<hr/>
				Grand Total	18,404
					<hr/>

*Estimate for the Fruit Experimental Station at Shillong.*

Details. 1	1st year.		2nd year.	3rd year.	4th year.	5th year.	Ultimate annual.
	Non-recurring. 2	Recurring. 3	Recurring. 4	Recurring. 5	Recurring. 6	Recurring. 7	Recurring. 8
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
<b>ESTABLISHMENT.</b>							
1 Overseer (Rs. 30—4/2—50).	..	360	360	408	408	456	492
1 Graftor mali (Rs. 25—1—40).	..	300	312	324	336	348	384
Allowance, etc.— Travelling allowance of establishment.	..	50	50	50	50	50	50
Quarters for 1 overseer ..	1,200	..	..	..	..	..	..
Quarters for 1 grafter mali ..	1,200	..	..	..	..	..	..
Godown ..	1,000	..	..	..	..	..	..
Labourers' shed ..	500	..	..	..	..	..	..
Reclamation and fencing ..	800	..	..	..	..	..	..
Implements ..	200	..	..	..	..	..	..
Furniture ..	100	..	..	..	..	..	..
Seeds, plants and manures ..	..	1,000	1,000	1,000	1,000	1,000	1,000
Wages of labourers ..	..	1,500	1,500	1,500	1,500	1,500	1,500
Miscellaneous contingencies— Stamps, office expenses, etc.	..	500	500	500	500	500	500
Petty repairs ..	..	200	200	200	200	200	200
<b>Total ..</b>	<b>5,000</b>	<b>3,910</b>	<b>3,922</b>	<b>3,982</b>	<b>3,994</b>	<b>4,054</b>	<b>4,126</b>

					Rs.
Total non-recurring ..	..	..	..	..	5,000
Total recurring expenditure for 5 years ..	..	..	..	..	19,862
					<hr/>
				Grand Total ..	24,862
					<hr/>

*Estimate for the appointment of one Marketing Enquiry Officer for one year.*

Details.	Amount.
	Rs.
Pay at Rs. 250 per mensem ..	3,000
Travelling allowance ..	2,000
One peon at Rs. 11 per mensem ..	132
Contingencies ..	368
	<hr/>
<b>Total ..</b>	<b>5,500</b>
	<hr/>

## ANNEXURE XI.

*Extracts from the proceedings of the Advisory Board, January 1931.*

*Revised scheme of research in fruit-growing in Madras (Annexures I and II)-*  
 (b) *Scheme from Assam for investigating the possibilities of fruit culture in Assam (Annexure X).*—“There was a general feeling in the Board that there was need for fruit research both in the provinces and at a central station. As it happened the only provinces which had submitted schemes of fruit research were Madras and Assam (Annexures I, II and X). The Board was of opinion that instead of considering individual isolated schemes it would be better if a committee were to go into the whole question of fruit research in India and submit proposals for work. At the same time it was felt that such a proceeding would not be quite fair to Madras which when it had come to the Board with a scheme for fruit research at its last meeting in June 1930 had been asked to revise it in certain respects and in the hope also that in the interval other provinces concerned would submit fruit schemes so that the problem could be discussed as a whole. No other province, except Assam (Annexure X), had done so and it was rather hard that Madras which had revised its scheme (Annexures I and II) should have to wait a further period for its consideration.

On the other hand the Board felt strongly that the problem should be tackled as a whole and, with the consent of Mr. Hilson, the Madras representative agreed that a fruit committee should be constituted which would meet about three months hence to sift schemes of fruit research and to make proposals; that this committee should examine the Madras scheme first and that the scheme, if approved by the committee with or without amendment, should be submitted direct to the Governing Body without its being brought before the Advisory Board as would be done in the case of other schemes. The period of three months was given to enable provinces to come forward with such proposals for fruit research as they thought necessary.

The Board also agreed with Mr. Plymen that full advantage should be taken of such assistance in the examination of schemes as the Imperial Bureau of Fruit Production at East Malling could render. Though such a proceeding was somewhat unusual it would probably be advisable in view of the fact that very little scientific work on fruit had of recent years been done in India to utilise the store of information available at the Bureau.”

## ANNEXURE XII.

LETTER FROM MOHAMMED SHAFEE DAOODI, M.L.A., TO THE CHAIRMAN, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, DATED SIMLA, THE MAY 1931.

I have the honour to say that the Department of Agriculture in the Centre or in the Provinces have so far paid no attention to fruit production. There is no dearth of good fruits in India. The mango in Bombay and in Bihar and the orange in Assam and the Central Provinces are instances of good fruits which are cultivated with profit. There is a considerable traffic in them and the trade brings in a large amount of money to the orchard-owners, the merchants and the middle men, and also provides substantial employment to basket makers and a host of packers and labourers. Unfortunately the mango does not appear to be an annual crop. There is a widespread belief that the tree flowers in alternate years, but common observation shows that a bumper crop succeeds another only after some years. A failure or partial failure causes tremendous loss to many people in the

country. No systematic work seems to have been done on this crop, and the causes and the conditions of the soil and climate or any internal condition of the tree brought by heavy cropping, insect attack or disease, that affect fruiting have not been ascertained, nor has any experiment been done on the best method of treating and manuring an orchard. Such experiments and observations require great care and attention, no doubt, and will take up the whole time of the workers for a considerable number of years, as trees in an orchard vary greatly in strength, age, size and cropping propensities, and in an experiment of this kind errors due to individual variation have to be minimised. The Provincial Departments of Agriculture in Bombay and Bihar should be made to take interest in this kind of work, as in these provinces trees bearing good quality fruits are abundant. If the Imperial Council of Agricultural Research bring this matter to the notice of the Provincial Agricultural Departments and promise financial help, the provinces are likely to take up the work which if successful is expected to give a lasting credit to scientific research.

#### ANNEXURE XIII.

LETTER FROM M. S. A. HYDARI, Esq., I.C.S., SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, TO MOHAMMED SHAFEE DAQODI, Esq., M.L.A., No. 1409-AGRI., DATED SIMLA, THE 26TH JUNE 1931.

I am directed to acknowledge receipt of your letter (Annexure XII) on the subject of Research on Fruit Production.

2. As regards the specific point of research on fruit production raised in your letter, I am to inform you that the Council has already appointed a Fruit Committee to sift schemes of fruit research and to make proposals. All the Provincial Departments of Agriculture are aware of the appointment of the Committee which will meet in January next. There are at present five schemes of Fruit Research from four different provinces (Madras, Assam, Bengal and Punjab) which will be considered by the Committee. The Assam Scheme for experiment on Fruit Culture includes research on oranges. The scheme from the Punjab for experiments on the preservation of fruits includes investigation into the possibility of more extensively utilising mangoes, etc. The Bengal scheme includes experiments on methods of culture including cultivation, pruning and propagation of mangoes and litchis, etc. If in the interval between now and the meeting of the Fruit Committee a scheme of Mango Research comes from Bihar or from any other Province this Department will be glad to include it among the schemes submitted for the Committee's consideration.

3. The Bombay Department of Agriculture are also collaborating in work on the cold storage of mangoes with a view to their export abroad with the assistance of Dr. Zilva. A scholarship has been granted by the Empire Marketing Board to Dr. Cheema, Horticulturist to Government, Bombay, for the study of the methods of the marketing of fruits, especially mangoes.

4. If you have no objection copies of your present letter will be placed before the Fruit Committee for consideration.

#### ANNEXURE XIV.

LETTER FROM MOHAMMED SHAFEE DAQODI, Esq., M.L.A., BANKIPORE (PATNA), TO THE SECRETARY, IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH, SIMLA, S. W., DATED PATNA, THE 30TH JUNE 1931.

With reference to your letter No. 1409-Agri., dated the 26th June 1931 (Annexure XIII), I am glad to note that the Council has appointed a Fruit

Committee. It is sad that the Bihar and Orissa Department of Agriculture has not submitted any scheme of Mango Research as yet, though the other provinces are paying attention to Fruit Research. Mango Research being a very important problem so far as Bihar is concerned, I would request you to forward copies of my correspondence on the subject to the Department of Agriculture, Bihar and Orissa, for taking necessary steps into the matter.

I have no objection in copies of my letters being placed before the Fruit Committee for consideration.

#### ANNEXURE XV.

PROCEEDINGS OF A MEETING OF THE FRUIT SUB-COMMITTEE HELD ON THE 26TH JANUARY 1932 AT 2-45 P.M. IN THE COMMITTEE ROOM OF THE SOUTH BLOCK, IMPERIAL SECRETARIAT, NEW DELHI.

##### *Present.*

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, *Chairman.*
2. Director of Agriculture, Madras.
3. Director of Agriculture, Bombay.
4. Director of Agriculture, Bengal.
5. Director of Agriculture, United Provinces.
6. Director of Agriculture, Punjab.
7. Director of Agriculture, Central Provinces.
8. Mr. HEAD, Deputy Director Gardens, Saharanpur.
9. Mr. TAIT, Publicity Officer, Railways.

The Chairman said that the Imperial Council of Agricultural Research had decided that fruit problems for India should be considered as a whole ; that invitations had been sent to all provinces to send any fruit schemes they wished to be considered and that as a result the schemes now before the Committee from six provinces, *viz.* : Madras, Bombay, Bengal, United Provinces, Punjab and Assam. had been received. These schemes have been printed and form appendices to the note by the Secretary.

##### *Madras Schemes.*

The Director of Agriculture, Madras, was asked to explain his two schemes.

He said that Mr. Butcher—the officer-in-charge of fruit culture—had been relieved from potato work and was now doing practically only fruit work ; also that the only contribution which the Madras Government would make to the schemes was the services of Mr. Butcher who is getting Rs. 750 per mensem. Owing to its financial condition, he said, his Government was not in a position to provide for any recurring or non-recurring expenditure, and it could not afford to purchase the necessary land for the proposed extensions. He thought it might be possible to get some Government waste land. A lease would be out of question. It would not be economical, as 20 to 25 years were necessary to get the best out of fruit trees. So the only possibility was to use Government waste land.

After considerable discussion it was decided that the Plains Scheme was the more important and that only the Plains Scheme should be proceeded with for the present. No definite site had yet been fixed for this scheme.

Coming down to the details given on page 4 of the scheme it was decided that under "A" non-recurring 1st year the land must be provided by Government.

Under item (2) the store clerk's quarters and shed for oil engine should be omitted.

Under "B" recurring 1st year that the Farm Manager and Botanical Assistant should be omitted, and that one Assistant on Rs. 100—5—120 be inserted :

that T. A. for staff for the fruit survey should be reduced to Rs. 500, and that for working expenses contingencies, purchase of plants and miscellaneous a total sum of Rs. 3,500 should be provided ; also that this reduction in staff, T. A., working expenses, contingencies, purchase of plants and miscellaneous should hold good throughout the five years.

With these alterations it was decided to recommend the scheme for the consideration of the Advisory Board. The costs will, therefore, be as follows :—

### FRUIT RESEARCH STATIONS—PLAINS.

#### A.—NON-RECURRING—I YEAR.

	Rs.
Capital Outlay :—	
1. Land—30 acres to be given by Government.	
2. Buildings :—	
(i) Office and store .. .. .	2,500
(ii) Implement and cart shed .. .. .	656
(iii) Cattle sheds (for 2 pairs) .. .. .	500
(iv) Farm Manager's quarters .. .. .	3,500
(v) Potting and grafting shed .. .. .	900
(vi) Coolie's sheds .. .. .	600
3. Livestock :—	
Two pairs of cattle at Rs. 300 per pair .. .. .	600
4. Dead stock :—	
(i) Pump and oil engine .. .. .	1,200
(ii) Pipe masonry channels and laying of the land for irrigation .. .. .	1,000
(iii) Fencing .. .. .	3,000
(iv) Implements and tools, etc. .. .. .	600
Total .. .. .	15,056

#### B.—RECURRING I YEAR.

1 Pay of establishment :—	
1 Superintendent at Rs. 250 × 12 (250—25—350) .. .. .	3,000
1 Assistant on Rs. 100—5—120 .. .. .	1,200
1 Clerk, Rs. 35 × 12 (25, 35—1½—50) .. .. .	420
1 Peon, Rs. 12 × 12 .. .. .	144
1 Fieldman, Rs. 35 × 12 (Rs. 35—1½—50) .. .. .	420
2. Allowances—Travelling allowance for staff for carrying out fruit survey .. .. .	500
Working Expenses .. .. .	}
Contingencies .. .. .	} 3,500
Purchase of plants and miscellaneous .. .. .	}
Total .. .. .	9,184

## II YEAR.

1. Pay of Establishment :—					Rs.
1 Superintendent, Rs. 275 × 12	..	..	..	..	3,300
1 Assistant .. .. .	..	..	..	..	1,260
1 Clerk, Rs. 35 × 12 .. .. .	..	..	..	..	420
1 Peon, Rs. 12 × 12 .. .. .	..	..	..	..	144
1 Fieldman, Rs. 36½ × 12 .. .. .	..	..	..	..	438
2. Allowances—Travelling allowance					500
Working Expenses .. .. .	..	..	..	..	} 3,500
Contingencies .. .. .	..	..	..	..	
Purchase of plants .. .. .	..	..	..	..	
Total .. .. .					<u>9,562</u>

## III YEAR.

1. Pay of Establishment :—					
1 Superintendent, Rs. 300 × 12	..	..	..	..	3,600
1 Assistant .. .. .	..	..	..	..	1,320
1 Clerk, Rs. 36½ × 12 .. .. .	..	..	..	..	438
1 Peon, Rs. 12 × 12 .. .. .	..	..	..	..	144
1 Fieldman, Rs. 38 × 12 .. .. .	..	..	..	..	456
2. Allowances—Travelling allowance					500
Working Expenses .. .. .	..	..	..	..	} 3,500
Contingencies .. .. .	..	..	..	..	
Purchase of plants .. .. .	..	..	..	..	
3. Dead stock :—					
Purchase of another pump and oil engine	..	..	..	..	1,200
Total .. .. .					<u>11,158</u>

## IV YEAR.

1 Pay of Establishment :—					
1 Superintendent, Rs. 325 × 12	..	..	..	..	3,900
1 Assistant .. .. .	..	..	..	..	1,380
1 Clerk, Rs. 38 × 12 .. .. .	..	..	..	..	456
1 Peon, Rs. 12 × 12 .. .. .	..	..	..	..	144
1 Fieldman, Rs. 39½ × 12 .. .. .	..	..	..	..	474
2. Allowances—Travelling allowance					500
Working Expenses .. .. .	..	..	..	..	} 3,500
Contingencies .. .. .	..	..	..	..	
Purchase of plants, etc. .. .. .	..	..	..	..	
Total .. .. .					<u>10,354</u>

## V YEAR.

1. Pay of Establishment :—					
1 Superintendent, Rs. 350 × 12	..	..	..	..	4,200
1 Assistant .. .. .	..	..	..	..	1,440
1 Clerk, Rs. 39½ × 12 .. .. .	..	..	..	..	474
1 Peon, Rs. 12 × 12 .. .. .	..	..	..	..	144
1 Fieldman, Rs. 41 × 12 .. .. .	..	..	..	..	492
2. Allowances—Travelling allowance					500
Working Expenses .. .. .	..	..	..	..	} 3,500
Contingencies .. .. .	..	..	..	..	
Purchase of plants, etc. .. .. .	..	..	..	..	
Total .. .. .					<u>10,750</u>



*Abstract of the cost of the Madras Fruit Research Scheme as recommended by the Fruits Sub-Committee.*

	Capital outlay.	Pay of establishment.	Allowances.	Working Expenses, etc.	Total.
	Rs.	Rs.	Rs.	Rs.	Rs.
1st year .. .. .	15,056	5,184	500	3,500	..
2nd year .. .. .	..	5,562	500	3,500	..
3rd year .. .. .	1,200	5,958	500	3,500	..
4th year .. .. .	..	6,354	500	3,500	..
5th year .. .. .	..	6,750	500	3,500	..
<b>Total .. .. .</b>	<b>16,256</b>	<b>29,808</b>	<b>2,500</b>	<b>17,500</b>	<b>66,064</b>

*Bombay Scheme.*

The Director of Agriculture, Bombay, explained that in April last the Imperial Council of Agricultural Research had addressed the Bombay Government asking it to co-operate with the Empire Marketing Board in sending consignments of mangoes to England. The Bombay Government had previously sent samples of mangoes into the London market with fairly successful results and the Empire Marketing Board has asked this experiment to be repeated. It was impossible to test the market for a new commodity unless regular supplies were available over a fairly long period as buyers were rarely interested in a line which could not be repeated. Further a single shipment afforded little opportunity of investigating the optimum stage of maturity for export. The idea of the scheme was to test the London market and the possibilities of an export trade from India. Mr. Main said that he simply asked the Imperial Council of Agricultural Research to finance the Empire Marketing Board's proposal.

Mr. Mehta stated that Bombay fruit growers already got good prices for their alphanso mangoes and that many Bombay people could not afford to buy these mangoes at present prices. He did not see the necessity of developing an export trade especially in view of the fact that the supply of these mangoes was limited.

The Chairman was of opinion that since they had started this test of the London market it was worthwhile to extend the test in co-operation with the Empire Marketing Board. It was a matter of Rs. 4,000 only and he thought this could be met.

In the result the Committee agreed to recommend the scheme as it was a continuation of previous work and of interest to all India.

*Bengal Scheme.*

An objection was raised that the two schemes submitted did not give sufficient details to which the Director of Agriculture, Bengal, replied that after the full debate at the meeting held in January last it was considered that details were not necessary. In explaining the scheme he said that as regards fruits Bengal mangoes, pineapples, litchis, plantain, etc., were well known outside

Bengal and that any fruit scheme that left out Bengal would leave India the poorer. He said his Government offered land and most of the buildings but the rest of the expenditure, he was afraid, his Government could not afford to give at present.

After discussion it was decided that only the Plains Scheme should be proceeded with for the present, and this was then considered in detail.

The Director of Agriculture explained that the programme of work was practically the same as that of Madras. They had been doing fruit work for a considerable time and this scheme as a whole had been approved by the Bengal Government in 1922 but he had never had the money to put it into operation. It was originally intended to be a local scheme but the results would be useful in the neighbouring provinces of Assam, Bihar and United Provinces. Apart from mangoes and litchis he thought there was a great scope for the introduction of improved types of guavas, custard apples, mangosteens, citrus fruits, etc. He emphasised that owing to financial stringency the Government of Bengal was unable to allot funds for the development of fruit culture and hoped that the scheme would be subsidised by the Imperial Council.

Mr. Main felt that the mango and plantain problems might be tackled first and Mr. Plymen said he did not want every one to be working at the same fundamental problems. Mr. Plymen's idea was that in the case of methods of propagation for example mango stocks might be taken up in some provinces, while citrus stocks might be taken up in others. In the result it was agreed to recommend the scheme for sanction with the following amendments, viz.:-

*Non-recurring—*

- (a) Laying out and fencing to be reduced from Rs. 5,000 to Rs. 3,500.
- (b) Field Laboratory and office to be reduced from Rs. 5,000 to Rs. 2,500.
- (c) Quarters for field assistant to be changed to quarters for Horticultural Officer.

(Mr. Finlow stated that there had been a misprint of this item as this was the intention).

- (d) Pottery shed, Rs. 250 to be omitted.
- (e) Bullocks 6 pairs costing Rs. 1,500 to be reduced to four pairs costing Rs. 1,000.
- (f) Implements and apparatus Rs. 1,000 to be reduced to Rs. 750.

*Recurring—*

*Omit.—(a) House rent for Horticultural Officer Rs. 300 per annum.*

*Replace.—(b) House rent for clerk @ Rs. 60 per annum by House rent for Clerk and Field Assistant @ Rs. 200 per annum.*

*Replace.—(c) Labour Rs. 960 per annum.*

Feed of cattle Rs. 1,500 per annum.

Contingencies Rs. 1,000 per annum

by

Labour, Feed of Cattle and contingencies @ Rs. 2,500 per annum.

*Replace Travelling Allowance Rs. 1,000 per annum by Travelling Allowance Rs. 500 per annum.*

The cost will therefore be :—

NON-RECURRING.

	Rs.
Laying out and fencing .. .. .	3,500
Field laboratory and office .. .. .	2,500
Quarters for Horticultural Officer .. .. .	3,000
Quarters for malis, peons and coolies .. .. .	2,400
Bullocks shed .. .. .	1,000
Bullocks, 4 pairs .. .. .	1,000
Implements and apparatus .. .. .	750
Total .. .. .	14,150

RECURRING.

	First year.	Second year	Third year.	Fourth year.	Fifth year.
	Rs.	Rs.	Rs.	Rs.	Rs.
Horticultural Officer .. .. .	3,000	3,240	3,480	3,720	3,960
Field Assistant .. .. .	600	630	660	690	720
Clerk .. .. .	360	360	360	360	360
House rent for Clerk and Field Assistant .. .. .	200	200	200	200	200
1 Peon on Rs. 13-0-0 per mensem .. .. .	156	156	156	156	156
4 Malis on Rs. 15-0-0 per mensem .. .. .	720	720	720	720	720
Labour .. .. .	2,500	2,500	2,500	2,500	2,500
Feed of Cattle .. .. .	2,500	2,500	2,500	2,500	2,500
Contingencies .. .. .	500	500	500	500	500
Travelling allowance .. .. .	500	500	500	500	500
Total .. .. .	8,036	8,306	8,576	8,846	9,116
	Rs. 42,880				

*United Provinces Schemes.*

Two schemes were for consideration. One for the Kumaun Hills and the other for the plains of the United Provinces.

Mr. Mehta stressed the great extent and the importance of fruit growing in the United Provinces ; the facilities for developing the industry and the keenly felt want of scientific advice and assistance among the large number of fruit

growers. He laid a good deal of stress on the importance of the Hills scheme, but after discussion it was decided for the present to recommend only the plains scheme with the following alterations :—

Page 12. From the *non-recurring* expenditure.

*Omit—*

	Rs.
Land .. .. .	20,000
Buildings, packing shed, store room and office room ..	2,000
Malis quarters .. .. .	2,000
Roads .. .. .	3,000
Fencing .. .. .	4,000
Masonry water channels .. .. .	3,500
One tube well .. .. .	8,000

The scheme as recommended for consideration by the Advisory Board will therefore cost as follows :—

*Non-recurring—*

	Rs.
One tube well .. .. .	8,000
Cost of digging holes for trees .. .. .	300
Manure .. .. .	2,500
Cost of trees .. .. .	3,000
Implements .. .. .	500
Cattle .. .. .	400
<b>Total non-recurring</b>	<b>14,700</b>

*Recurring—*

This was left unaltered.

Mr. Mehta stressed the importance of the Hills scheme and he urged that if he could be given a sum of Rs. 4,640 he would be satisfied ; but it was decided that the Hills scheme should be sent back to be revised, and put up again.

#### *Punjab Scheme.*

Mr. Milne explained that in the mango growing districts of Hoshiarpur, Gurdaspur, etc., there is such a glut of fruits that they do not fetch even 8 annas a maund and thousands of maunds of fruits were never picked which could be preserved and sold as useful food to people.

Similarly that in the orchards of the Kulu Valley thousands of maunds of good fruits went to waste every year which could be preserved in some form or other and sold at prices much below those at which imported fruits are sold at.

Similarly that there was great scope for helping both growers and consumers by the tinning of peas, manufacture of tomato sauce, etc. People were already showing a great desire to start work in these directions and were asking for

guidance. What was needed was some investigation into the possibilities of these lines of work and give the people a start. The scheme was a very modest one and the potential benefits to the growers were very great. He hoped the Committee would give the required assistance.

In reply to an objection raised by Mr. Mehta that the scheme was purely an industrial one Mr. Milne said that there was a general demand for information of the sort which the officer proposed in the scheme would be able to give after local investigation. They quoted a number of people coming to start this industry and they were asking them to lead the way by giving instruction. They had a man who had spent two years in California studying this subject and he would be placed under the guidance of the Fruit Specialist who had several years experience in this line in California. The object of the scheme was to adapt modern methods of fruit preservation to the conditions of the fruit growing area in the Punjab.

After considerable discussion it was decided to recommend the scheme for a period of two years in the first instance.

*Assam Scheme.*

The Committee felt it was unable to deal satisfactorily with the scheme in the absence of an Assam representative who could furnish information.

## APPENDIX XXXIII

SUBJECT No. 27.

## REPORT OF THE SUB-COMMITTEE ON THE SCHEME FOR EXPERIMENTAL WORK ON EVOLUTION OF MACHINERY FOR THRESHING AND CLEANING WHEAT IN THE PUNJAB.

Attention is invited to the attached note (Enclosure and Annexures I—IV) circulated to the members of the Sub-Committee appointed to consider the above scheme. The proceedings of the Sub-Committee will be found in Annexure V.

The recommendations of the Committee are now for the consideration of the Advisory Board.

M. S. A. HYDARI,

*Secretary.**The 28th January 1932.*

## ENCLOSURE.

*Scheme for Experimental Work on the evolution of machinery for threshing and cleaning wheat in the Punjab. (Appendix I.)*

At its meeting held in June 1931, the Advisory Board decided (Annexure II) that a Committee should be appointed to examine and report on the scheme for experimental work on the evolution of machinery for threshing and cleaning wheat submitted by the Government of the Punjab. The selection of the personnel of the Committee was left to the Chairman. During the discussion in the Advisory Board it was emphasized that this problem arose in all the wheat growing provinces but that conditions differ and that therefore the question should be approached from an all-India basis.

2. The Chairman has accordingly appointed the undermentioned Committee for this purpose :—

1. Diwan Bahadur Sir T. VIJAYARAGHAVACHARYA, *Chairman, Ex-officio.*
  2. Mr. B. C. BURT, Agricultural Expert, Imperial Council of Agricultural Research.
  3. Mr. F. J. PLYMEN.
  4. Mr. D. MILNE.
  5. Mr. G. S. HENDERSON.
  6. Mr. MILLER BROWNLIE, Agricultural Engineer to Government, Punjab.
- Mr. M. S. A. HYDARI, *Secretary, Ex-officio.*

The United Provinces Government have also been invited to send a representative.

3. The Committee will meet during the next session of the Advisory Board on an afternoon which will be fixed later to meet the convenience of members between the 25th and 27th January 1932.

4. The papers (Annexure I) circulated to the Advisory Board in June 1931 in connection with the Punjab Scheme as also an extract (Annexure II) from the Proceedings of the Advisory Board held in June 1931, and a note (Annexure III) by Mr. J. C. Reed are attached.

T. VIJAYARAGHAVACHARYA,

*Secretary.*

*The 31st December 1931.*

#### ANNEXURE I

*Scheme for experimental work on the evolution of machinery for threshing and cleaning wheat (cost Rs. 1,21,800).*

1. The process of threshing and cleaning wheat in India is a very long and laborious one, severe on both man and animal since it falls at the hottest and busiest season of the year. For generations the work has been accomplished by the tedious process of trampling by bullocks. The work is often interfered with by circumstances, particularly climatic which are beyond the control of the zamindar; circumstances which may and often are the cause of heavy damage to the crop. The work of threshing is generally delayed as the zamindar is then busy sowing his cotton and other Kharif crops. Also the cleaning of the grain may be held up due to the absence of wind while the threshed grain may, perhaps, lie at the mercy of the weather for days and even weeks at a time when thunder-storms accompanied by rain are not an uncommon feature of the season.

2. It will thus be readily understood that if any means can be found of threshing and cleaning the crop more speedily and economically than at present such would be of untold value to the cultivators of the country.

3. The Punjab Agricultural Department have been conducting experiments with wheat threshing machinery since about the year 1907. During this time about ten machines have been tried, but for one reason or another none has been found satisfactory. The appended note will give an idea of the work that has been done and the results obtained. The Agricultural Engineer to Government, Punjab, is of opinion that modifications to existing machines will not satisfy requirements and that an entirely new design is necessary. He considers that progress only can be made if an experienced designer is available to work on the problem and suggests that the following staff should be recruited for a period of five years :—

One Executive Engineer (Implements).

One Draftsman.

One Clerk.

Two peons.

Details of the expenditure involved each year are attached.

4. As threshing and winnowing problems are very important not alone to the Punjab but to all India the Research Council might be asked to contribute a grant towards their solution. A cheap winnower suitable for separating grain and bhusa and for giving a rough cleaning to the grain is also a machine for

which there undoubtedly would be a large demand if one were available. It is, therefore, proposed that this problem should be studied simultaneously with the larger one of threshing. A brief note of the work already done in this direction is also appended.

*Details of expenditure referred to in paragraph 3.*

	1st year.	2nd year.	3rd year.	4th year.	5th year.
	Rs.	Rs.	Rs.	Rs.	Rs.
Engineer— Rs. 1,100—100—1,500 ..	13,200	14,400	15,600	16,800	18,000
	£	£	£	£	£
Plus £ 30 Overseas pay ..	360	360	360	360	360
	Rs.	Rs.	Rs.	Rs.	Rs.
Draftsman—Rs. 250 per mensem .. ..	3,000	3,000	3,000	3,000	3,000
Clerk—Rs. 50 per mensem	600	600	600	600	600
Peons—Rs. 15 per mensem (including compensatory allowance) .. ..	360	360	360	360	360
Total: .. }	Rs. 17,160	18,360	19,560	20,760	21,960
	£360	£360	£360	£360	£360

Total for 5 years = Rs. 97,800.  
Plus £ 1,800 or Rs. 24,000.

*Note on wheat threshing experiments conducted at Lyallpur.*

In the year 1907 the Punjab Agricultural Department started experimental work on wheat threshing by means of machinery. Since then many threshers have been tried but so far for one reason or another none have been found entirely successful.

The threshers tried can be divided into four types, *vis.* :—

- (1) Simple drum threshers which only extract the grain from the ears.
- (2) Threshers containing drum and shakers only. These besides threshing, partially separate the grain from the straw.
- (3) Simple finishing threshers which thresh, separate the straw from the grain and roughly clean the grain.
- (4) Threshers which separate the grain from the straw, clean the grain and also make the straw into bhusa.

Of all these types the latter alone completely fulfils the requirements of the zamindar.

Below is given a summary of the observations and deductions made on the work of the various threshers tried at the Lyallpur farm classifying them under the heads given above.

Of the first type—simple drum threshers—four machines have been tried; in one of these the drum beat upwards, in the other three it beat downwards.



Those beating downwards proved more successful as they effected a certain amount of separation of grain and straw; the grain falling out through the bars of the concave while the straw passed out behind the drum. The upward beating machine effected no separation at all, the grain and straw being thrown in one heap behind the machine.

Although the "downward-beating" machines proved more suitable than the "upward-beating" type neither were found useful or economical as the bulk of the work remained to be done, *e.g.*, cleaning of the grain and bhusa-making—after the crop had been dealt with by the machine. It was, therefore, considered that they in no way lessened the labour required, or reduced the cost of threshing.

All the machines tried were worked by a bullock gear.

Two machines of the second type have been tried, *i.e.*, machines fitted with a drum and shakers. One of these had feeding rollers the other not. Both threshed the crop successfully and effected a certain amount of separation of grain and straw—but very little more than the down beating single drum (first type) as most of the fine straw fell through the shakers and was mixed up with the grain. Neither of these machines was considered to be either economical or useful. Both were power-driven machines.

The next type tried, *vis.*, the simple finishing thresher containing drum, shakers and one cleaning outfit were more successful. They threshed the crop, separated a proportion of the straw from the grain and cleaned the grain fairly well but did not make bhusa. Two of these machines were tried; one with a "peg-type" of drum and the other with a "rubbing type". Both threshed equally well; there being little difference in the percentage of grain broken. But the output was too low for them to be economical, and the grain required a final cleaning. The output of one was 6 maunds per hour and the other 8 maunds per hour. The low output of both these machines was due chiefly to most of the straw being badly broken up by the threshing drum. This broken straw passed through the shakers and caused chocking at the entrance to the caving riddle. Certain structural alterations were made in them in the hope of overcoming the defects but with little success and they were given up. Both machines were power driven.

The fourth type, the complete finishing thresher, threshed the crop, separated the straw from the grain, gave the grain a final cleaning and also made the straw into bhusa. Two of this type were tried. Their working has been described by Mr. W. Roberts, in the Agricultural Journal of India, volume X, Part III—July, 1915. The output of the 30 in. wide machine was 4.62 maunds per hour while the output of the 48 in. machine was 12.74 maunds per hour. The quality of the bhusa produced was described as good. From 2 to 5 per cent. of the grain was damaged. These were large machines and a certain amount of difficulty was experienced in moving them about from place to place. Both were driven by a Portable Steam Engine. No costs of threshing were worked out at the time but we now know from the figures of output obtained that they were uneconomical.

Our experience has shown that the problem of threshing wheat by machinery in the Punjab is very difficult to what it usually is elsewhere. The Punjab has a very dry and hot climate at the harvesting season. The dry hot atmosphere causes the straw to become very brittle. When this brittle straw is fed into any thresher fully 80 or 90 per cent. of it is broken up into fine pieces. This broken straw has

been the chief obstacle in the way of obtaining a satisfactory output as it has always caused considerable choking with consequent delays and low output of all the finishing threshers yet tried. The problem now is to find a thresher which will overcome this difficulty and at the same time fulfil the following five requirements:—

- (1) Thresh the grain satisfactorily without breaking too large a percentage.
- (2) Separate the grain from the straw.
- (3) Give the grain a final cleaning.
- (4) Make the straw into bhusa.
- (5) Give an economical output.

The estimated cost of threshing wheat at Lyallpur by bullocks and cleaning by hand is annas 9 per maund. If a machine could be obtained which would thresh at the same rate or even a little higher it would probably mean a great saving to zamindars as it would enable them to get the crop off the ground much earlier than they do at present and thus save it from damage by storms, etc., and leave them more time to prepare the land and sow their kharif crops.

The general opinion here is that the kind of thresher required is the fourth type, i.e., a machine which performs threshing, cleaning and bhusa-making all in one operation. Accepting this view the next point to be decided is the kind of machine likely to be most successful as there are two types of "finishing threshers" already on the market, viz.:—

- (1) The type tried at Lyallpur from 1911 to 1915 which performs the threshing and bhusa-making in the first drum, then the separation of the grain and bhusa and finally cleaning of the grain.
- (2) The English standard type wherein threshing alone is done in the first drum and bhusa-making in another drum after the grain has been extracted from the straw.

The faults of the first type are that it damages more grain, and for the same size of machine gives a lower output than the second type.

We are, therefore, left with a choice of the second type unless an entirely new machine can be designed.

*Evolution of a winnowing machine suitable for separating grain from bhusa.*

The evolution of a winnower suitable for separating bhusa from grain and for cleaning the grains is of considerable importance to all India and the demand for such a winnower is certain to be large if a suitable machine is forthcoming. The ordinary type of winnower now in use at our farms is only suitable for giving a final cleaning to grain.

Much experimental work has already been done at Lyallpur on the evolution of such a special purpose winnower. A machine containing a fan, and very large riddles has been constructed—chiefly from wood—and given a good trial.

It gave an output of 10 maunds per hour (cleaned grain) when worked by two men but the wood frame did not stand the intense heat prevailing here at harvesting time, and the machine quickly broke up.

The Agricultural Engineer then constructed another machine mainly with steel but this was found too heavy for one man to turn, so further experimental work is in progress.

The problem is not a very difficult one and if solved would be of untold value to zamindars as it would enable them to clean their wheat quickly and render them more independent of the vagaries of the wind and weather. Such a machine would also enable them to clean their grain much better than they can do at present.

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ANNEXURE II.

EXTRACT FROM PROCEEDINGS OF THE MEETING OF THE ADVISORY BOARD OF THE IMPERIAL COUNCIL OF AGRICULTURAL RESEARCH HELD AT SIMLA ON MONDAY, THE 8TH JUNE 1931.

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SUBJECT No. 6.

SCHEME FOR EXPERIMENTAL WORK ON THE EVOLUTION OF MACHINERY FOR THRESHING AND CLEANING WHEAT IN THE PUNJAB (SUBJECT NO. 4 OF THE AGENDA).

After Mr. Stewart had explained the scheme Dr. Agharkar asked whether the same object could not be achieved by offering rewards instead of by employing an expensive Expert for 5 years. Mr. Henderson said that the question dealt with by this scheme was an extremely important one not only for the Punjab but also for the Central Provinces and Sind. The last mentioned province would at no distant date become a great wheat producing province. He would, however, set about it in a somewhat different fashion. He would get designers from manufacturing countries to come to India to see conditions and on their return design suitable machines. He suggested therefore that the Council should interest firms in the matter. Mr. Milne said that a prize would not be attractive enough for firms. A firm would have to spend Rs. 20,000 or Rs. 30,000 on experiments and at the end of it would not be sure whether it would get the prize and therefore the custom. Professor Ganguli said that there was no guarantee that Mr. Miller Brownlie could now succeed in five years when he had not done so for the last 20 years. He therefore agreed with Mr. Henderson and suggested that firms like Messrs. Kirloskar Brothers in this country should first be approached. In reply to Professor Ganguli Mr. Milne said that Mr. Miller Brownlie the Agricultural Engineer in the Punjab, had not had sufficient time to devote to this question. It was therefore not correct to say that he had been engaged on it for the last 20 years. The proposal in the scheme was to engage an Engineer who would be guided by Mr. Miller Brownlie. The latter had already many inventions to his credit. Mr. Devadhar doubted whether other provinces like the Central Provinces and Sind would be able to utilise the machine which was suitable for Punjab conditions. Mr. Plymen was inclined to agree with Professor Ganguli that firms should be invited to interest themselves in the matter. He suggested that the Council should ask firms to tender and then entrust the work of designing to one firm for a settled sum of money. He doubted, however, whether there was very great scope for a threshing machine. If the ryot used it how was he going to employ his bullocks. He thought that the economic aspect should also be considered. On the whole therefore he was inclined to be against the scheme. If the Punjab had not used their Agricultural Engineer as the Principal of the Agricultural College he would probably have had more time for agricultural engineering. Mr. Sethi said that it would not be enough to design one machine. There should be two—one bullock driven and

the other power driven. Mr. Henderson said that that was a very good point. There were a large number of threshing machines, e.g., for barley in India but they were very big and they were not suited for wheat. What they required was something which the small man could use. Mr. Main gave general support to the scheme but demurred to what had been proposed, namely, that an Executive Engineer should work under Mr. Miller Brownlie. What they wanted was a specialist. Mr. Stewart explained that during the last 20 years Punjab had tried some 10 threshing winnowing machines. But they had been unable to devote their full attention to the problem. They had ideas as to what such a machine should be but they had been unable as yet to put them into practice. Mr. Reed said that a firm like Agricultural General Engineers might be willing to send a designer if they could be given a guarantee of purchase for say five years. Otherwise it would not pay them for if they brought out a successful design and patented it another firm could with a small variation take out another patent and thus deprive the original designer of the fruits of his work. Mr. MacGregor asked why a period of 5 years had been put to the scheme. Why, for example, could the designing not be over in 3 years or 2½? Mr. Hewlett referring to Mr. Plymen's point about the utilisation of bullocks said that they should set about getting a good winnowing machine and leave threshing to be done by bullocks. The Chairman at this stage put the various proposals made in the course of discussion to the vote. Those about recommending the Punjab scheme as it stood about awarding a prize and inviting a firm or firms to design a machine were rejected in favour of the proposal to appoint a Committee which should examine and report on the scheme. The selection of the personnel of the committee was left to the Chairman.

### ANNEXURE III.

#### *Scheme for experimental work on the evolution of machinery for threshing and cleaning wheat in the Punjab.*

Might I suggest that the following proposal in broad outlines be put before the Sub-Committee that you have appointed to decide whether the Punjab scheme be adopted. The proposal refers to the 3rd alternative put before the meeting yesterday, namely, utilisation of the manufacturers of agricultural machinery. It is obviously undesirable that the Government of India should in any way show preference for any one manufacturer and for that matter, on a point of efficiency, for the manufacturers of any one country and therefore in place of my suggestion at yesterday's meeting to approach the Agricultural and General Engineers Co. exclusively. I would suggest that the Imperial Council of Agricultural Research on behalf of the Government of India approach the Trade Commissioners of the United Kingdom and the U. S. A. in addition to any firms in India manufacturing this type of machinery the two leading countries in the manufacture of agricultural machinery and advise these officials to the effect that the Government of India wish to invite one or two firms from each country to design a suitable threshing and winnowing machine for wheat under Indian conditions. (Suggest not more than two firms from each country to prevent scheme becoming cumbersome.)

The following would be the conditions suggested:—

1. The manufacturers would agree to send out an expert designer within .....months to study the practical requirements of the Imperial Council of

**Agricultural Research under their nominees in the Punjab, United Provinces and Central Provinces.**

2. The manufacturer would agree that the basis of any designs made and submitted must besides fulfilling the practical requirements of the Council's nominees also be of a nature whereby the price when manufactured on a large scale will fall within the limits imposed by the Council of Agricultural Research. The Government of India would agree to examine the designs submitted and select one only and then only if it fulfills the practical requirements, etc., of the Government's nominees. The Government of India's decision being final as to whether a design is suitable or not.

The Government of India would agree that the design selected whether followed by similar design from other manufacturers will for a period of..... years recommend exclusively this form of Thresher and Winnower for use of the cultivators in India where machinery is required.

The Government of India would agree that during the first three years that this machine is marketed they would subsidize the successful designer on a basis to be subsequently agreed up to Rs. .... (Such figure to be say one half or three quarters of the sum requested by the Punjab Government, this of course to be decided by the Governing Body of the Council.)

During the first three years the machine is manufactured and marketed in India.

The question of the form in which the subsidy is paid and the amount requires further consideration but it should be in a manner to allow the initial price of the machine to be as low as possible in fact it should aim at assisting the firm in selling from the outset at mass production prices because normally the price charged would be on the actual cost of production for the sales estimated during the first year and such would be far higher than a mass production price based on a steady demand of fair proportions.

By such a subsidy the Imperial Council of Agricultural Research would obtain a machine on the market at a lower price initially and thus give its use a chance to develop and the manufacturer would when sales had developed be able to supply at an economic price unsubsidized.

In the Punjab scheme even though after 5 years a satisfactory machine is evolved the manufacturing problem at a low price has still to be solved whereas the above would have a fair chance of solving both problems at a less cost to the Government of India than the solving of only one.

J. C. REED.

ANNEXURE IV.

*Note by Mr. Wynne Sayer on experiments with threshing machinery at Pusa.*

The threshing problem in the wheat tracts of India has received considerable attention in the Agricultural Section at Pusa and this note aims at giving an account of the work that has been done and the present position of the problem.

In the main wheat growing areas of India, threshing is performed by bullocks which tread out the grain from the heads and the grain is winnowed from the chaff and straw by fanning or the use of rough winnowers or even by throwing the mass into the air in the west wind for separation. Examination of

the pile of wheat sheaves, when the bullocks have finished their trampling, shows that the operation of actual threshing the grain out from the head is neither well nor thoroughly done and compared with the subsequent operations of cleaning and winnowing by far the largest proportion of grain is lost in the actual treading out.

It is thus evident that the chief need of the small wheat grower is an efficient machine for knocking out the grain from the head and if this can be done properly the subsequent operations are well within his compass.

His financial position, however, precludes any large expenditure on machinery and the *sine qua non* in the rural tracts is that a machine must be simple to work. If it is intricate it is constantly either idle owing to breakages or working most inefficiently owing to faulty adjustment. We are, therefore, able to stipulate for the following essentials.

I. The Thresher must thresh out the grain from the ear efficiently and without breakage beyond the minimum. It can only perform any subsequent operations, if they can be linked with the actual threshing, with the minimum of cost, machinery, and weight.

II. It must be portable, light, and easy to work and adjust.

III. It must be cheap and built of some material which will last and not warp in heat.

IV. It must make bhusa, as the dual operation of the bullocks while threshing, is to make bhusa from the straw by constant treading, bhusa being straw thoroughly smashed and cut into small pieces.

V. The prime mover must be cheap, easy to work and capable of moving the outfit from place to place.

All the standard threshers available in India are only suitable for large farms and planters' estates. They turn out clean grain and long straw and are nothing but the application of home designs to the conditions in India where suitable. They do not help us in any way in regard to the main threshing problem in India, as they are far too expensive, heavy and complicated for the ordinary small wheat grower of some 10 acres or so.

We have three of this type at Pusa :—

- (1) Marshalls' Class A 4-6 drum with self feeder—sheaf and straw elevator.
- (2) "Case" 20 × 28 light weight all steel thresher fitted with straw blower.
- (3) "Consul" Ransomes 27-ft. drum with straw chopping apparatus.

Comparison of their work, cost and general upkeep compared with the actual work done by bullock threshing has enabled us to supply the following specification to all makers of threshing machinery for India.

It is required to design and introduce a suitable threshing outfit which will be simple self-contained and cheap for a cultivator growing 8—10 acres of wheat—the machine to thresh the kernels out of the heads, deliver the straw in one lot and cavings chaff and grain in another. The cavings chaff and grain to be winnowed separately by a winnower or in the usual way and the long straw to be subsequently trodden into bhusa by bullocks.

In connection with this problem Mr. Henderson in 1922 designed and brought out from England an all steel thresher of which the following are the specifications.

*Machines.*—Portable on 4 wheels.

*Frame.*—2½-ft. × 2½-ft. × 3½-in. Ms. Angles.

*Sides.*—Sheet steel.

*Weight.*—25-30-cwt.

*Height.*—5-ft. — 4½-in.

*Drum.*—3 ft. fitted with beater plates.

*Drum speed.*—1000 R. P. M.

*Concave.*—Not adjustable.

*Shakers.*—3 all steel.

*Power.*—6 HP. Oil Engine.

*Output.*—About 15 maunds wheat per hour.

This machine was tried at Lyallpur in 1922. The report of its working is attached.

*Lyallpur, Trials, 26th October 1922.*

#### *Henderson Thresher.*

Total weight of grain threshed 54 Mds. and 19 Srs.

(a) Unthreshed (recoverable)—2 Mds. and 10 Srs. (4.10 per cent. of whole).

(b) Broken grain (unrecoverable) 1 Md. (1.8 per cent. of whole).

Time of threshing 5 hours and 53 minutes = 9 Mds. per hour. (Previous letter stated 30 Mds. of wheat were threshed in 45 minutes roughly 20 Mds. per hour).

Austin Tractor as prime mover.

{ 7½ gallons kerosene.  
 { ½ gallons petrol.  
 { ½ gallon Mobile oil.

Sample of threshed grain was sent down to Pusa. Mr. Milligan (Agricultural Adviser) wrote that he regarded it as on the whole the best sample of wheat threshed by a power machine in India he had yet seen, the breakage being remarkably little.

In the report furnished on the Lyallpur trials various alterations were suggested including fitting of move wire riddle of ¼-inch mesh below shakers (this has been done in the Peasant thresher) and to redesign the machine so as to alter the direction of feed and make the concave adjustable, as according to Punjab report machine would never be a success owing to high amount of breakage.

To this Mr. Henderson did not agree and this opinion was not upheld by the conference of threshing machine experts who saw the machine working in 1929 and whose recommendations are included in the conference report.

At Pusa it has worked very satisfactorily and has proved most useful in dealing with the large number of small experimental wheat plots requiring to be threshed separately—its extreme simplicity making it possible to clean it in a few minutes.

Silage cutters have also been tried between 1923-1926 for threshing and making bhusa. But in all cases the experiments proved unsatisfactory. Much wheat was damaged and there was grave risk of fire in the bhusa blower. (We actually had one serious fire from this cause). The experiments were finally abandoned.

In 1929 in accordance with the policy of getting manufacturers to see the actual conditions for themselves Mr. Sayer held a conference of representatives of various firms interested in the manufactures of threshers during the threshing season at Pusa. The four threshers at Pusa were run and their work tested and criticised.

At the end of the testing run a meeting was held and the whole problem fully discussed.

The conference was attended by Messrs. Dalgarno and Lawson of Marshalls; Gainsborough—Marshalls; Messrs. Lingel and Girling—Case threshers; Messrs. Sitwell and Hanahan—Ransomes.

Mr. Sayer said the threshing problem in India had been attacked upside down. Large modern threshers suitable for big Farms and Planters' Estates had been supplied and were working successfully mostly on oats, but this was not the real Indian problem. At present it was impossible to get a small cheap light movable thresher of simple design which would primarily thresh. This being the work chiefly required. The ryot could do all subsequent operations himself with fair efficiency. All firms interested in India as a potential market for threshers had got to realise that this was what the real demand was for and to deal with that demand they had got to start from the beginning. Merely taking out everything but the drum from a modern thresher would not serve the purpose what was required was first absolute simplicity, that is, a machine which could take the grain out of the ear thoroughly and to accomplish that would be to get things started. Mr. Dalgarno displayed a photo of a new all iron thresher which his firm had just brought out absolutely simple in design, which was now at Jubbulpore. Mr. Sayer pointed out that both an automatic feed and an elevator were unnecessary. Mr. Lingel said the bottom blast and the ball bearings could also be dispensed with—stripped of all this could the Thresher be done for under Rs. 1,500.\* If so then a start could be made.

As regards the portable power unit the general idea favoured an oil engine of some 12—15 HP.

Mr. Sayer, however, urged that with a thresher, as simple as the one designed, a bullock power unit could work if a heavy fly wheel was fitted to keep it regular.

The question of the lightening of the fly wheel for transport had already been overcome. Mr. Dalgarno promised to experiment. Mr. Lingel stated that so long as 5 per cent. was taken off clean wheat for impurities nothing would be gained by power threshing and this practice must be stopped first.

The final sense of the meeting was that the problem as realised had to be attacked from the beginning and that the thresher designed by Mr. Henderson represented the working minimum.

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\*N.B.—This refers to 1928 crisis.



The question of the power unit had to be gone into and it was useless to have a cheap thresher and an expensive power unit. The manufacturers promised to experiment on this basis.

It was generally suggested that the following alterations be made to the Henderson thresher—

- (i) Bullock gear to be attached and worked.
- (ii) Concave to be in 3 pieces and led further round.
- (iii) Beaters to be given a guide to avoid grain breaking.
- (iv) Shakers to be placed in eccentric to the ends.
- (v) Riddle to be fitted below.

The possibilities of a crude oil tractor and its greatly cheapened haulage and running costs are now being tested and the possibilities of a prime mover of this order are being worked out.

As a result of the consideration of the recommendations arrived at by the manufacturers' conference referred to above the line of investigation was slightly altered in 1930 and in 1931 a small 'Peasant' type thresher was brought out for trial by Mr. Sayer.

This is the first attempt at mass production and carries with it the essential points of cheapness and light weight. The machine weighs  $14\frac{1}{2}$  Mds. and costs £40; it consists of a steel frame of rigid construction on which is mounted the threshing drum (18×18) and concave. The driving pulley  $6\frac{1}{2}$ -in.×4-in. is securely keyed to the drum spindle but can be changed to either side as wished.

The threshing drum is of the open type provided with 6 rows of steel pegs of special form all securely mounted on a strong spindle running on ball bearings. The concave is adjustable and of cast iron with 4 rows of pegs. This is fitted against the drum and fastens when set by two bolts. The machine is equipped with wooden shakers and a caving riddle. It is mounted on 4 cast iron wheels with a front axle for turning and a pole for haulage.

It is designed to be driven by a small  $2\frac{1}{2}$ —3 HP. Engine, the drum being rated at 1000 RPM.

The machine was tried in 1931 at end of the season. It was driven by a Fordson tractor. This power proved too high for the machine and the wood frame of the riddle was shaken to pieces, preventing the completion of the trial. What work was done was quite good.

It is being tested with a bullock gear this coming season and the whole outfit will make short excursions to villages to work under realistic conditions. The bullock gear is to be arranged so that it will be possible for the bullocks to tread out the bhusa while driving the thresher. By this means it is hoped that the two problems of transport and bhusa making will be dealt with satisfactorily.

The capacity of the machine is some 4.5 maunds per hour.

It is intended to invite manufacturers to see further developments this year and to make any new suggestions or alterations regarding design.

## ANNEXURE V.

*Proceedings of the Sub-Committee for examining and reporting on the scheme for experimental work on the evolution of machinery for threshing and cleaning wheat submitted by the Government of the Punjab.*

This Sub-Committee met on the 27th January 1932 at 3 P.M. The following members were present :—

1. Diwan Bahadur Sir T. Vijayaraghavacharya. *Chairman.*
2. Mr. D. Milne.
3. Mr. F. J. Plymen.
4. Mr. D. R. Sethi.
5. Mr. Miller Brownlie, Agricultural Engineer, Punjab.
6. Mr. Low, Deputy Director of Agriculture, Cawnpore.

The Chairman after referring to the relevant papers regarding the discussion on the subject during the June, 1931 meeting of the Advisory Board asked Mr. Milne to open the discussion.

Mr. Milne referred to one of the suggestions put forward at the June, 1931 meeting of the Advisory Board—that of tackling the problem by offering a reward for a suitable design—and pointed out the impracticability of such a course being adopted. In support of his contention he instanced the case of an Engineer in the Punjab who had just brought out an entirely new design of a Persian Wheel but had not competed for the Sir Maynard-Ganga Ram Prize offered by the Punjab Government for such a wheel for the reason that the models for the new wheel had cost the designer as much as the prize was worth and he did not want to run the risk of the prize and his design also.

The Chairman referred to Mr. Reed's note (Annexure III) submitted to the Advisory Board at its June, 1931 meeting wherein he had stated that the best way of tackling the problem was by inviting the threshing machinery manufacturers in India, England, and America to send out designers to study the problems involved with a promise either of a monopoly for a definite period or a guarantee for the purchase of a definite number of machines to the successful firm. Monopolies were apt to be questioned and it was also not possible to give any guarantee regarding the purchase of a definite number of machines in the absence of a definite demand. He, however, thought that firms, perhaps, were in a better position to design a suitable machine than anybody else.

Mr. Low said that his enquiries, from the manufacturers, while on leave in England, had elicited the fact that firms would be willing to design a suitable machine provided the purchase of at least ten such machines was guaranteed.

Mr. Plymen was of the opinion that it would considerably simplify the problems involved if all the machines possessed by the provincial Departments were tried in one central place under a competent Agricultural Engineer, their defects studied and then designers invited to study the problems involved.

Mr. Sethi explained the views of Mr. Henderson who had done a good deal of work in this connection. Briefly Mr. Henderson considered that the scheme under consideration was not the right way to go about the subject. The best method was by inviting firms to send out designers for studying the problems involved; the Imperial Council of Agricultural Research undertaking to pay their expenses.

Mr. Sethi was of opinion that as there was, and would not be for a considerable time to come, any demand for an expensive set of machinery the question of how to tackle the problem of designing did not arise and should not be considered. Mr. Plymen agreed with Mr. Sethi's view and expressed his doubts about the utility of such expensive machinery which aimed at eliminating the bullock except possibly in the irrigated tracts of wheat growing areas. Mr. Sethi was of opinion that a suitable Bhusa winnowing machine had a far better chance of being adopted by the cultivators than a threshing outfit which even if small, was bound to be beyond the reach of the average cultivator in the wheat belt. Mr. Plymen while agreeing to this suggestion was of opinion that unless it was cheap and efficient it had no chance. And as regards threshing machines they were bound to be expensive and therefore out of the question as there was no demand for these. Mr. Milne agreed that a suitable winnower was the more urgent requirement but was of opinion that both threshing and winnowing problems must be studied together. What was required was an expert who would tackle both problems at the same time. The Chairman asked Mr. Brownlie to state what would be the probable cost of a suitable small threshing set. Mr. Brownlie replied that it was not possible to give definite figures but he was of opinion that a small thresher produced on mass production basis without the bhusa attachment, the winnower, and the prime mover could not be marketed at less than Rs. 1,000. An efficient winnower using bullock power would cost not less than Rs. 500 and a suitable bullock gear to work this winnower an additional Rs. 200. Mr. Brownlie further stated that all the existing western designs of threshers and winnowers were absolutely useless for Indian conditions and it was essential that machinery suited to Indian conditions should be designed and this could only be done by having a qualified engineer capable of tackling the problems involved. Mr. Milne agreed with this view.

Messrs. Plymen, Sethi and Low agreed that there was no demand for threshing machinery at present in India. Mr. Milne was of opinion that a suitable winnowing machine was more urgent than a combined threshing outfit while Mr. Brownlie stated that given a suitable machine there would be a reasonable demand for threshers in the Punjab.

It was unanimously decided that the Imperial Council of Agricultural Research should be requested to advertise in India, Europe and America inviting firms of standing to send out qualified representatives to study the subject on the spot and to state what their terms would be for producing suitable machinery. In the advertisement it should be made clear that machinery is required for local conditions and must be efficient and cheap. The various Trade Commissioners concerned should be asked to bring this advertisement to the notice of firms concerned and the High Commissioner for India requested to help as far as possible.

In the meantime it was considered desirable to request provinces as well as Pusa to furnish full details to the Imperial Council of Agricultural Research on the trials of threshing and winnowing machinery that had been carried out up to date.